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Rural Electrification.

CONTINUING our series of articles on "Rural Electric Lines," this week, we commence publishing the views of Dr. Alfred Ekström, a Swedish engineer of the first rank, whose mature experience in the development of rural electricity supply with overhead lines—far more extensive in this respect, we believe, than that of any of our fellow-countrymen, whose work has mainly been carried out with underground cables in urban areas—enables him to speak with exceptional authority. He does not mince matters: he describes our regulations for overhead lines as "prohibitive in rural districts," and congratulates himself on the comparative freedom enjoyed by electrical engineers in Sweden.

Contrasting our regulations with those to which he is accustomed to work, Dr. Ekström shows that rural electric lines can be constructed at one-third the cost incurred under our existing code, and appeals to the teachings of practical experience in support of his claim that the Swedish system has afforded satisfactory results. Ours, on the other hand, not only greatly increases the cost of electricity to the rural resident, but also involves the use of unsightly structures, which deface the countryside and have been known to bring about the loss of life which they are intended to obviate.

As we have pointed out on previous occasions, it is not only contrary to public policy to prescribe ideals as working conditions, but is also an impracticable endeavour. The ideals here aimed at are twofold, namely, absolute reliability of service, and absolute safety to the person; and both are unattainable. In other public services more reasonable views prevail—fortunately, for were it otherwise, such services could not be maintained on an economic basis. The most flagrant example that comes to our mind in this connection is the electric trolley wire, which, as we have often pointed out, is suspended over dense traffic in our city streets by mechanical devices far less secure than the supports of rural lines, works at a pressure twice as great, and is constantly subjected to blows and stresses which are not imposed upon the latter. The risk of breakdown and the economic importance of interruption, as well as the danger to the person, are vastly greater in the case of the tramway than in that

of a country line, and it is impossible to justify the maintenance of academic regulations for the latter whilst the former remains exempt. As Mr. W. Fennell remarks, in a letter which appears in our "Correspondence" columns to-day, the Committee which drew up the regulations was not representative of those who are responsible for the erection of rural lines, and so far as we know, it made no effort to obtain their views; we believe that, if an inquiry were held at which those engineers could give evidence, a very different result would be attained.

The question, to our mind, is simply this: is the farmer to have a supply of electricity which may conceivably be subject to occasional temporary interruption during exceptional climatic conditions, or he is to have no supply at all? Under the existing regulations of the Electricity Commissioners and the Post Office, the latter alternative will in general be his fate.

The British Association.

AT the end of the month the British Association for the Advancement of Science is holding its 97th annual meeting at Leeds (from August 31st to September 7th). While B.A. meetings do not now hold so much interest for the electrical scientist and engineer as they did a few years ago, they still possess features of interest to our readers.

This year's president is Sir Arthur Keith, who will deal with the modern aspect of the Darwinian theory of man's descent. Prof. Sir J. B. Henderson is to preside over the Engineering Section and is to speak on "Invention." The subject of the address of Prof. D. H. McGregor, president of the Economics Section, is "The Rationalisation of Industry," a subject which is now receiving a great deal of attention from industrialists of all countries.

The papers to be read in the Engineering Section include one on "Super-tension Cables," by Mr. P. Dunsheath; "Switchgear," by Mr. H. W. Clothier; "The Mechanical Strength of Metallic Filament Lamps," by Mr. S. Murgatroyd; "The Jet Wave Rectifier," by Dr. J. Hartmann; "A Close Voltage Rectifier," by Mr. F. C. Turner; and several mechanical engineering papers which affect the electrical engineering industry. Among the joint discussions which have been arranged is one upon coal—its chemistry and utilisation. Prof. W. Cramp intends to demonstrate a hydraulic model illustrating the behaviour of the arc.

A study of the programme shows that the inevitable congestion will again arise, and it looks as though there will be little time for discussing the papers. Some of the Sections (not Engineering) are meeting on the Saturday morning. So far, over 2,500 people have signified their intention to be present at the meeting; this is well above the average.

Trade Problems of the Empire Family.

PARLIAMENT having risen for the recess, we shall have a measure of freedom from political speeches there at any rate for some months to come, unless any unforeseen event of importance should arise. One of the closing speeches in last week's proceedings in the House of Commons was the statement of the President of the Board of Trade, in the course of which he furnished considerable statistical and other information respecting the state of trade and the outlook for the future. It is plain that, speaking generally, our share of the export trade of the world is not returning quickly enough to what it was before the year 1914, however satisfied we may feel with the progress that has been made recently with the electrical export trade according to the figures quoted in our issue of July 15th (p. 99). While the Home market is now regarded as being of far greater importance than it used to be, with the need for increasing export trade in manufactured goods to pay for our imported food and raw materials, the imperative necessity for doing our utmost to extend our export trade within the Empire is being emphasised more and more. The constant need for vigilance in Empire marketing measures should lead to far greater activity on the part of responsible men in our manufacturing concerns, and we hope that the satisfactory electrical figures will not induce anybody to stay his hand. In some markets we are up against greater difficulties than it is reasonable to justify. For example, we might have supposed that the British manufacturer would have received very definite assistance from the six weeks' presence here of Mr. H. E. Pratten, the Minister for Trade and Customs in the Australian Commonwealth, but if, as producers of British electrical and allied goods, the chief advice that he has to vouchsafe is that our manufacturers should open branch factories in Australia in order to keep their present share of her trade and to secure that which now goes to the foreigner, he has done little good. Experience may point to successful possibilities of such a kind for some departments of everyday production, but we fear that past events will hardly encourage electrical producers to make any material ventures. If he had designed to give us a cold douche he could hardly have done it better. What we naturally look for in the midst of the Empire propaganda and spirit of these days is larger evidence of a desire to help industrial activity and employment in Great Britain and an interest in the population of these islands who look eagerly to the other members of the great Empire family to help them in their distress by using the goods produced in factories of which the present capacity is excessive.

Italian Electrical Progress.

THE report issued by the Department of Overseas Trade on Italy which is reviewed in this issue indicates a continuance of the rapid electrical development which has been in progress for some years. It unfortunately does *not* indicate, however, what is being done in the electrical manufacturing industry. Indeed, no direct reference appears to be made to that in any part of the report.

The trade statistics which are published following our review of that report show that Italy's electrical exports increased during the past year, particularly in the case of cables, which rose by nearly 60 per cent.

A special correspondent, in an article also published to-day, states that the three 30,000-kVA hydro-electric turbo-generators for the new Liro Inferiore station were manufactured by Italian companies. These sets are said to be the largest ever constructed in the country, and they afford an indication of the capabilities of Italian electrical manufacturers.

At the same time, the imports of electric generators and motors showed a large increase during 1926—an increase in which Great Britain did not share. We hope that future D.O.T. reports will contain some information regarding an industry which is rapidly becoming of greater importance.

Wiring Regulations for Wiremen.

THE issue of "The Employees' Guide" to the I.E.E. Regulations for the Electrical Equipment of Buildings, compiled by the Association of Supervising Electrical Engineers and published last week, is a notable event; it provides the wireman with a selection of regulations to which he ought to give particular attention, together with explanatory notes and diagrams which will render them more comprehensible, and at the same time, by implication, it gives weighty support to our contention that the existing code of regulations is too elaborate and complex for practical purposes. As the Institution announced in issuing the ninth edition of the Regulations, the tenth edition is to take a simpler form. We shall refer to the "Employees' Guide" more fully in a later issue; it can be obtained from the A.S.E.E., as indicated in our "Book Notices" to-day.

Rural Electric Lines.—III.

A symposium of the opinions of electrical engineers experienced in the construction of overhead lines in rural areas, with examples of methods that have been, or are to be, adopted for the distribution of electricity at low and medium pressures.

RURAL electrification schemes, in order to be remunerative, necessitate the building of transmission lines and the installation of distribution plant as cheaply as possible, without risking the security of the service. Accordingly, the regulations of a more or less official character which are issued for the guidance of electricity supply undertakers, for securing the safety of the public, exercise a cardinal influence upon the cost of any such scheme.

It is therefore of the first importance that the practical effects of regulations of this kind on rural electrification work should be made known to the British public, and the following article will facilitate comparison between English and Swedish practice in this respect. The author ranks with the foremost Swedish electrical engineers, besides being a practical all-electric farmer on a large scale at Ahlby, near Stockholm. (Previous articles in this series were published in our issues of July 15th and 22nd, 1927.)

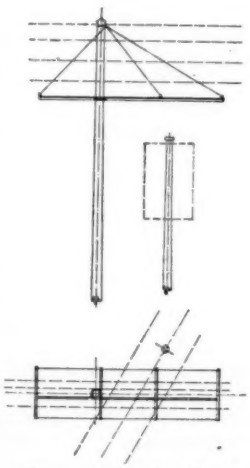


Fig. 1.—A Telephone Line Guard Frame.

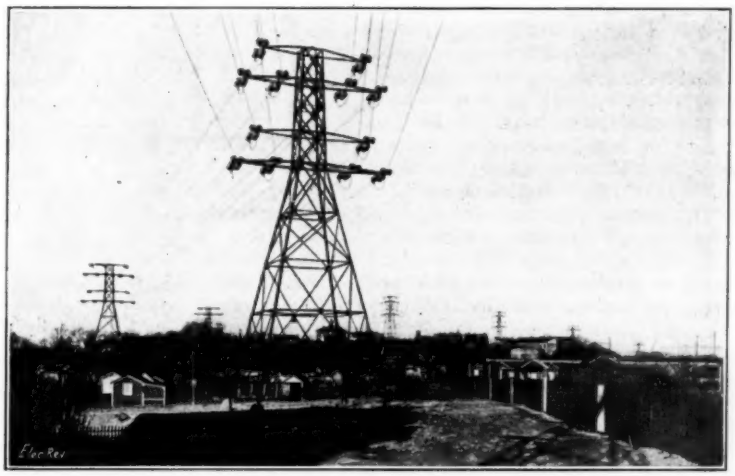


Fig. 2a.—"Safety" Crossing over State Railway Yard at Malmö

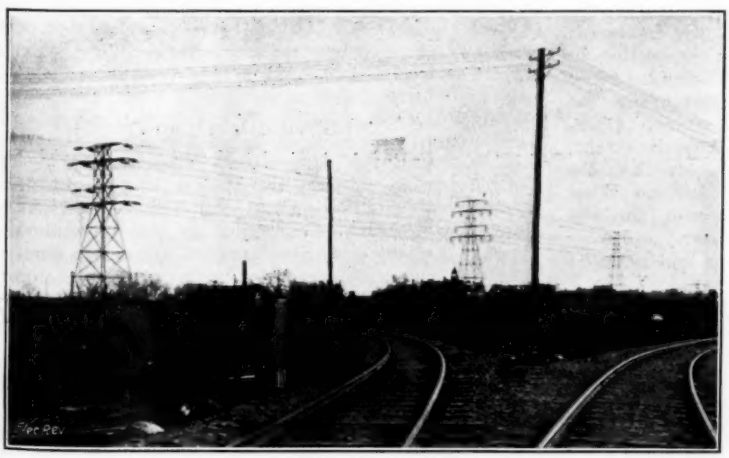


Fig. 2b.—Another View of the Swedish Line shown in Fig. 2a.

Pole-Line Regulations.

By ALFRED EKSTRÖM, D.Sc.

The British regulations are very detailed and rigorous; they prescribe, with the effect of a law, how transmission lines, &c., shall be constructed, and are prohibitive in rural districts.

In Sweden we have regulations of this kind also, but they are of a more general character and allow more liberty to electricity supply undertakers to select suitable constructions and arrangements in accordance with their experience. Developments in this field having been very rapid, it has been of great advantage to Sweden that regulations and orders of a legal character have not hampered progress, as has been the case in many other countries. The result of the electrification of Sweden, and not least its rural electrification, affords good proof that this system has been successful.

It has become the established practice in Sweden to grade the strength and service reliability of lines, and thus also the cost of their construction, according to the importance of the line. Just as a country barn can be, and ought to be, built much more simply and cheaply than a warehouse in a city, so ought a country line delivering a few kW to a few small country cottages to be erected under quite other regulations than those governing main lines for 10,000 or 50,000 kW. There may be a risk that a lightly constructed branch line erected to supply some remote cottage with electric light on cheap and reasonable conditions may be damaged during a sleet storm, which may occur only at intervals of many years. Proportions sufficient to ensure the line holding up under such exceptional conditions would considerably increase its cost, and hence the price of

the energy, so that no one could afford to pay it. A Swedish farmer considers it foolish to pay double or treble the price for his electricity to assure himself against such a rare disturbance, or interruption. The result of this system has been very satisfactory.

In opposition to these points of view, the English regulations affect all lines (except low-voltage lines) indiscriminately. Provisions and factors of safety, which in other countries only refer to important main lines, are in England applied also to the smallest branch lines to country villages. Such conditions explain why it has been impossible to carry out rural electrification work in England, and the following instances, amongst others, will explain why the English regulations increase costs.

Comparison Between British Official Electricity Regulations and Swedish Practice.—The prescribed additional loads to allow for ice and wind are so high, and the safety factor is so large, that the length of the spans will be unreasonably limited. For example, for 10 mm.² wire (S.W.G. 9) the English span is 75 ft., against 300 ft. used in Sweden for less important 20,000-, 3,000-, or 1,500-volt lines; for 16 mm.² (7/16) the English span is 120 ft., against 400 ft. in Sweden; for 25 mm.² stranded conductor (7/14) the English span is 200 ft., against from 600 to 800 ft. in Sweden, where steel towers are used. Such short spans augment considerably the cost of poles, supports, and insulators without increasing the security of the service. This triplication or quadruplication of the number of supports obviously involves inconvenience and trouble to the farmer, for which the electric power undertaking has to pay in the shape of substantially increased wayleave rental. Moreover, with the long spans adopted in Sweden, the poles can, to a great extent, be placed at the edges of ditches and at the boundary lines of fields, where they do not in any way interfere with agricultural work. The line sags allowed for these spans in Sweden are not so great that poles of more than normal length have to be employed.

The high values of ice loads and wind pressure prescribed in England also impose great stresses on the supports and poles, which thus have to be massive and dear; single poles will often not suffice, hence double poles and the like must often be employed. In Swedish practice, poles of normal length are used; for supports, simple and cheap constructions are employed, while arrangements for protection and disconnection in the case of breakage, &c., are much simpler and cheaper in Sweden than in England, but, notwithstanding, the security of service has been very satisfactory. Interruptions that have occurred have, to a small extent, originated from the lack of mechanical strength of the materials employed, *i.e.*, non-electric faults. What may have proved necessary in a few places is increased electric strength (larger and better insulators) and more convenient designs, though rarely dearer and stronger methods of construction.

Comparison Between British P.O. Regulations and Corresponding Swedish Regulations:—1. *Lines for Maximum a.c.* 250 *V and d.c.* 650 *V* (*denoted by I in Post Office Regulations*).—(*a*) Telephone wires crossing above power lines are found chiefly in densely-populated areas. Under the Post Office regulations earthed guard wires must be used, as is the ruling in Sweden, but the P.O. regulations stipulate that cross-laces shall be used when the crossing is not at right angles, which extra condition makes the arrangement ugly, expensive, and difficult to erect. On the strength of the experience gained in Sweden, it may be said that such cross-laces are unnecessary, and that this provision ought to be cancelled.

(*b*) When telephone wires cross below power lines, the English method of using earthed conductors with cross-laces below the power lines, which in certain cases was used in Sweden 20 years ago, has been entirely condemned in Sweden on account of the fact that this method of crossing has proved impracticable, and at times unreliable. The State Commissioners in Sweden do not any longer permit this method of crossing. Guard frames are used instead, which guard the telephone line placed near the power pole, arranged in accordance with the sketch in fig. 1 and earthed by connection to the neutral conductor. When a great number of telephone lines has to be guarded (as a rule only at railways and important highways), a crossing with a "safety" suspension is used, in principle corresponding to the high-voltage crossings shown in figs. 2a and b, and fig. 3. Proposals are, however, under consideration for simplifying and cheapening this "safety" crossing for low-voltage lines of less than 150 volts to earth.

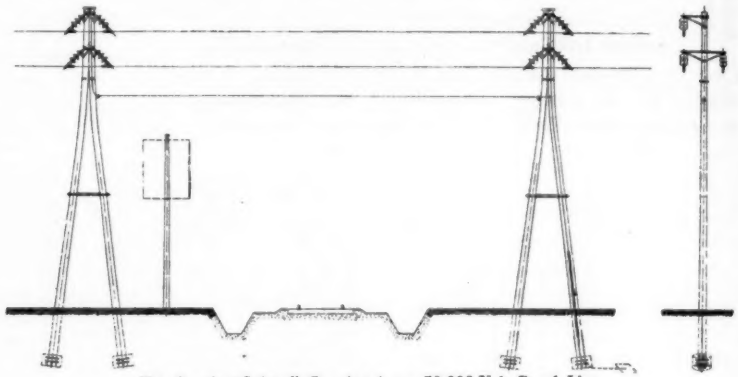


Fig. 3.—A "Safety" Crossing for a 50,000-Volt Rural Line.

2. *Lines for Maximum* 650 *Volts a.c. and d.c.* (*denoted by V in P.O. Regulations*).—The methods of crossing in this case are the same in principle as those outlined under heading 1. The severe conditions in this instance, *inter alia*, through the guard wires not being allowed to be connected to the neutral conductor, and on account of the fact that the guard wires are to be developed into complete cradle guards, render the arrangements dearer and inferior, and accentuate still more the criticism directed under heading 1 against this type of guarding device.

(*To be concluded.*)

Distribution Line Costs.

At the Royal Agricultural Show recently held at Newport (Mon.) the South Wales Electrical Power Distribution Co. exhibited a section of the type of overhead distribution line it employs in rural districts. At the present time the cost of erecting such lines, the company informs us, is approximately as follows:—

	£	s.	d.
Pole	2	12	0
Span of 3-phase wires	4	5	0
Switch wire	2	1	6
Insulators	0	6	0
Pole fittings, bolts, nuts, &c. ...	0	10	0
Labour and haulage	1	3	0
Total	£10	17	6

Each span is 50 yards long, and there are approximately 35 spans per mile, so that the cost of the line is £380 12s. 6d. per mile. Some 50 farms are using electricity supplied by the South Wales E.P.D. Co.

The E.H.P. Conference at Paris.

A Review of the Proceedings.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Continued from page* 138.)

THE second part of the Conference dealt with the construction of transmission systems. The 29 papers presented were classified in accordance with the paragraph headings which follow (the numbers in brackets after the authors' names are quoted so as to facilitate reference to the original papers). As evidence of the increasing interest taken abroad in high-voltage cables, it was noteworthy that no fewer than nine of the papers were devoted to this subject. As an illustration of the good that such conferences as this one accomplish, the attitude of certain American engineers in the early stages of the proceedings may be mentioned. They thought they were in a position to teach Europe a great deal; however, they found, as the result of the discussions, that over on this side a considerable amount of American work had been anticipated, in some cases by many years, though admittedly not on such a big scale. Hence the importance of engineers of many nations conferring together, which leads to greater progress.

During the Conference several of the papers were illustrated with kinematograph films, greatly adding to the interest of the proceedings.

Overhead Lines and their Supports.

Mr. P. Ferrier and Mr. H. Haussadis (7) explained their method of finding the most economical span for overhead lines. They maintained that the maximum financial efficiency is obtainable not by sacrificing the quality of the material, but rather by designing the line for the best conditions of operation. In average cases they state that economic spans are: 165 yards (150 m.) for unimportant lines; 220 yards (200 m.) for use with pin-type insulators; 330 yards (300 m.) for metal poles with suspension insulators; and 440 yards (400 m.) for reinforced-concrete poles with suspension insulators. These figures are of interest, as they differ considerably from British practice. In the discussion which ensued it was evident that it was considered that such calculations would have to be very considerably modified, so as to accord with the kind of country crossed.

Mr. R. Labbe (13) gave the conclusions drawn from an accident to a steel tower supporting a 75,000-volt line; it was an anchoring 6-conductor tower at a 60-deg. angle. A complete break of the tower occurred between the second and third cross-arms, after three conductors had been erected, due to the foreman putting up the wrong wires first, so that the tower was subjected to the maximum torsion on a structure with an insufficient margin of strength. Lessons were deduced that should improve future designs. This paper aroused a great deal of discussion.

Mr. C. Montagni (28) described the 240,000-volt, 300-kilometre Isarco-Turin line, built with reinforced-concrete standards made by the centrifugal process. This is the first line of this voltage in Europe.

Mr. R. F. Nuttal (53) described the use of small base (say, 16 ft. by 16 ft.) towers for 220,000-volt lines.

None of the papers dealt with welded-steel towers; accordingly Mr. Duquesne raised the question, and Mr. Duval and Mr. McMahon pointed out that this process had been used with success in France and in England.

Mr. J. T. Barron (71) described the New Jersey electrical distribution system, which already reaches 45 per cent. of an area of 3,400 square miles (average 900 inhabitants per square mile). A unique detail of the outdoor sub-stations is the inverted lights, mounted ten feet above the ground. This provides a clear upward view without glare.

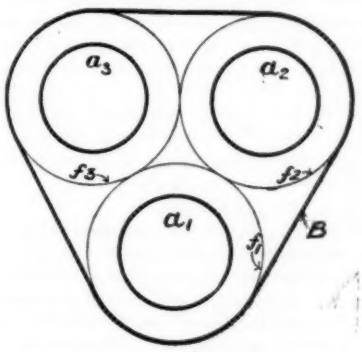
Another American paper was that of Mr. A. O. Austin (62) on the advantages and limitations of wood in transmission structures. In it reference was made to the new theory, in accord with which the common earth wire is converted to, or supplemented by, a charging or counter-potential wire, where lines are subject to lightning or potentials likely to cause insulators to flash-over. The paper dealt generally with the difficulties arising from the increased size and complication of modern systems.

The general conclusion to be derived from the discussions on the above reports was that the present-day tendency was to adopt long spans, supported on towers of lighter design than previously. The adoption of higher and higher pressures called for longer supporting arms; in turn, these would give trouble in the event of the breaking of one of the conductors, due to the big torsion effect.

High-Voltage Cables.

Much more attention was devoted to this subject this year than was the case at previous conferences.

Mr. J. G. Belaar Spruyt and Mr. J. C. van Staveren (3) reported upon comparative tests made in the Netherlands between the standard type of three-phase cable and metallised-paper (Höchstädter) cable, at a pressure of 10,000 volts. The dielectric losses were found to vary less with the pressure and temperature in the case of the latter type; also the electrostatic capacity of the



a_1 a_2 a_3 = conductors.
f_1 f_2 f_3 = metal foil.
B = lead sheath.

Fig. 1.—Cross Section of "So"-type Cable.

latter was higher, though the breakdown voltage to earth was less. Prices were practically equal for cables of both types. At higher voltages, it was considered that, on the whole, the advantages of metallised-paper cables would be the superior.

Dr. K. Konstantinowsky and Mr. L. Tschiassny (31) presented a report upon their investigations on the carrying capacity of high-voltage cables and also on the new "So" cable (so-called after the inventor—H. Sonnenfeld). Instead of having the familiar circular section, it is of triangular section with rounded corners (fig. 1). This cable is usually made in the metallised-

paper form, and does not differ from other cables from an electrical point of view; its great advantage is due to its better thermal quality, which permits of an increase of the carrying capacity by five per cent., coupled with a saving of insulating material, lead and armouring. These cables can be manufactured by the usual process, and there is no difference in the splicing method.

Mr. J. B. Whitehead and Mr. F. Hamburger (39) dealt with their experiments on the influence of residual air and moisture in impregnated-paper insulation. At atmospheric pressure most of the absorbed moisture is given off between 75 and 80 deg. C. They pointed out the importance of the humidity of the external air at the time of drying, as the more humid the air, the less effective were the results obtained. One of the striking results of their investigation was the necessity for an absolutely close fitting lead-sheath, as the presence of layers of air cause a rising break in the power-factor curve.

Mr. E. S. Lee (29) gave some notes on the effect of occluded gas pressure on the ionisation characteristic of insulation, in which the question of voids was ventilated.

In a paper by Mr. C. F. Proos (38) on the curve of dielectric losses as an index of the qualities of cables, he pointed out the danger of hot spots in cables and the importance of studying dielectric losses, as these could be used as an indication of the quality of a cable.

Mr. J. Delon (24) read a paper concerned with tests on high-voltage cables, in which he pointed out that there were many defects in the present systems of testing, *e.g.*, the usual voltage tests are rather a check of the cable's resistance to surges than to ageing. His view was that the life of a cable should be from 25 to 30 years; hence tests should be employed that would give some evidence of the probable life of a cable. More standardisation of testing methods was essential. A paper which also dealt with the latter point was that of Mr. J. G. Belaar Spruyt (68), who gave particulars of the Dutch National Committee's requirements in this respect.

The above-mentioned papers were discussed together in a very vivacious manner. It was recalled that the 1925 Conference had contributed considerably as an important factor in the progress of this subject. As a number of the members expressed their views as to the importance of the standardisation of cable tests, it was decided to appoint a sub-committee to co-ordinate the data available so as to serve as a basis for international agreement later on. Messrs. J. G. Belaar Spruyt, Soleri, and J. Delon were appointed on this sub-committee. From the discussion it was obvious that Continental engineers were taking far more interest in cables than was the case some years ago.

The subject of cable condensers was touched upon by Mr. S. Silberman (64), who considered that at present there was no reliable construction in use for large capacities and for very high working voltages; hence he had attempted a solution, which was described in this paper. The main field of application of these condensers is for the correction of power factor at voltages of over 10,000 V and when large corrective units are required.

Insulators.

Mr. A. Montandou and Mr. Y. le Moigne (23) dealt with the troubles encountered on a 70,000-volt line along the sea-shore in Morocco, which had failed in spite of the precautions usually adopted for lines in such exposed positions. Two new suspension-type insulators were described as suitable for overcoming salt deposit troubles, one with additional ribs and the other with an oil bath contained in each unit. Arising out of the discussion (in which Major T. Rich took part), attention was drawn to another problem in connection with sea-coast lines which had not been properly investigated, namely, the best way of dealing with the static charges induced on the lines by the action of the sea waves and the effect these charges had on increasing salt deposition on the insulators.

A joint discussion took place on the papers presented by Mr. F. M. Gillespie and Mr. F. Dejong (46) on the practical requirements for insulators for h.p. lines, including a reference to the "Aislometer" testing instrument; Mr. F. Dejong (47), testing of insulators on live h.p. lines; and Mr. G. Lequerler and Mr. P. Schuep (77), on the law of variation of the life of a suspension-type insulator as a function of the electrical and mechanical stresses which act upon it simultaneously. From this they deduced the safety coefficients. In the course of the discussion, Mr. E. O. Meyer expressed the opinion that artificial ageing methods for insulator testing purposes had not proved very effective.

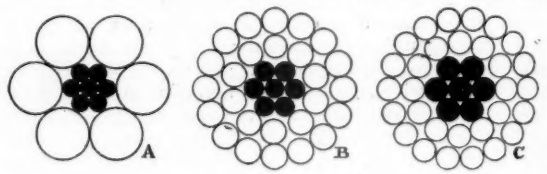
Mr. K. A. Hawley (58 and 59) presented two papers, one dealing with the protection of strings of suspension insulators and the other with a new type of Hewlett insulator. The conclusion arrived at in the former paper was that the most effective protection for a suspension insulator string was a grading shield at the lower end and an arcing horn at the upper end.

Messrs. G. R. Falkiner, G. R. F. Nuttall, B. L. Goodlet, P. Perrochet, and Gillespie took part in the discussion, which may be summed up as a call for careful consideration of the various new methods of testing advocated by the various authors.

Aluminium Conductors.

The most interesting paper in this section was that of Mr. E. T. Painton (48), as it reviewed the whole position of this class of conductor and also its use in conjunction with steel cores, right up to date. Constructional details were given of the newer methods of jointing called for by the use of steel-cored cables and the longer spans permissible with their adoption. The paper was illustrated with lantern slides. An interesting comparison was that of different types of steel-cored aluminium conductor of equivalent resistance (fig. 2).

Mr. G. R. F. Nuttall (54) developed a very simple method for the determination of the elongation of bi-metallic conductors. In comparing copper and aluminium conductors, Mr. E. Pairson (57) stated that the



	A	B	C
Aluminium stranding ...	7/·208	26/·100	30/·0929
Steel stranding	7/·0693	7/·0785	7/·0929
Ratio of aluminium to steel sections ...	7·72	6·05	4·29
Breaking load	9,134 lb.	10,587 lb.	12,820 lb.

Fig. 2.—Different Types of Steel-cored Aluminium Cable of Equivalent Resistance.

recent production of magnesium and silicon alloys had completely altered the aerial-line problem. Formulæ were given to simplify calculations.

Mr. W. C. Binz (66) described the practical methods employed in the construction of several important American high-voltage lines with steel-cored aluminium conductors. This paper was illustrated with 16-mm. kinematograph films, many of which were taken under obviously difficult conditions, where another type of camera could not have been so conveniently operated. The films certainly showed that any supposed difficulties in the construction of lines with steel-cored aluminium had been successfully overcome.

In the *résumé* of the technical reporter for this section (Mr. Duval), the hope was expressed that the new points brought out in these meetings, concerning the supports, the insulators, the overhead conductors and the cables would be carefully investigated and reported upon at the next Conference in 1929. In other words, a part of the agenda for the next conference is already in shape to be worked upon.

(To be concluded.)

The Induction Ammeter.

The Principles Involved and Means of Improving the Design.

By FRANCIS E. J. OCKENDEN.

(*Concluded from page* 174.)

THE necessity of having the pole pieces of the unshaded pole in such close proximity to the flux paths round the shaded pole makes it impossible to avoid a considerable degree of leakage inductance in the shading winding, and experiment shows that the use of this device will not produce more than 35° of flux displacement, and that only with an unreasonable

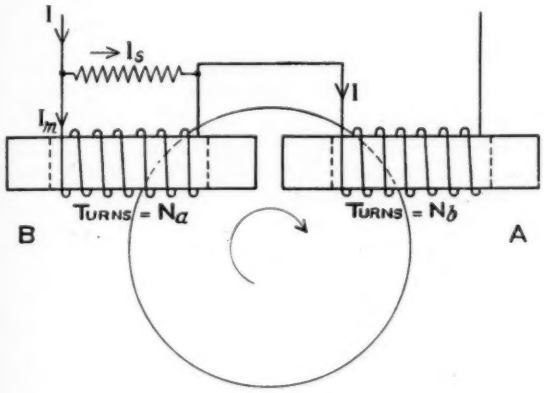


Fig. 5.

reduction in its magnitude. It has been shown that this angle should be at least 45°, and it will further be shown that inherent compensation for both frequency and temperature changes can be obtained by actually exceeding this angle. Some means capable of producing such a displacement must be sought, therefore, if a satisfactory induction instrument is to be designed.

Referring to fig. 2 (B), it will be noticed that the primary current I is made up of two components, I_m and I_s, I_s being the primary counterpart of the secondary current I_{s1}. Plainly, the primary current could have been split up in a similar way, and a vector diagram similar to fig. 3 drawn, were the primary winding carrying the current I_m shunted by a non-inductive resistance carrying the current I_s, and provided that the resistance of the primary winding is low compared with its inductance, ensuring that the voltage across it is closely at right angles to the flux (a condition quite easy to obtain), there is no difficulty in

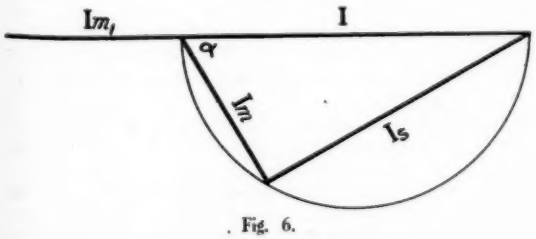


Fig. 6.

making I_s of any magnitude considered desirable, and at the same time in preserving the quadrature phase relationship between I_m and I_s, as shown by the full lines in fig. 3.

It is not possible, under these conditions, to give the shunted (or shaded) pole, and the unshunted pole, a common winding: each pole, therefore, is wound with a separate winding and to reduce magnetic interference to a minimum, the two cores, instead of being mounted side by side, are mounted end to end.

The general arrangement is given in fig. 5, which shows a plan of the two magnets and disk, winding A being shunted with a non-inductive resistance, and winding B being unshunted and wound with a coil in series with A, and in the same sense. The flux at the pole tips of B, therefore, is reversed relative to that of A, resulting in the direction of rotation of the disk being reversed; *i.e.*, it tends to move from the shunted to the unshunted pole. By this means, interference between the poles is made to assist, rather than otherwise, the production of flux displacement. Since the flux produced by the magnet B will be directly proportional to the current I, and that in A will be proportional to I_m (*i.e.*, I cos a), the formula for torque and the circle diagram shown in fig. 3 will hold good for this arrangement of the poles, and since it is now possible to obtain any desired value of I_s, and consequently any desired value of a, it becomes of importance to consider the effect of making I_s so great that a exceeds 45°. For this purpose, fig. 3 is redrawn in fig. 6.

I, as before, is the main current, split up by means of a non-inductive resistance into two components at right angles to one another, I_m and I_s. I_{m1} is the reversed magnetising current of the unshaded pole. In practice, the shading effect of the disk causes a slight

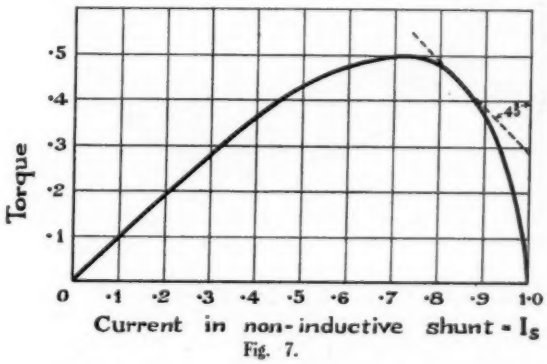


Fig. 7.

phase displacement of both I_m and I_{m1}, but as the deviation is in the same sense and is of approximately the same magnitude for both, it may be neglected and the net phase angle only need be considered. It is usual, also, to vary the turns N_a and N_b on each magnet in such a way as to make the ampere turns $I_{m1} N_b$ and $I_m N_a$ approximately equal, thus minimising interference, due to very unequal fluxes, and also the voltage drop across the instrument, by obtaining an equal distribution of inductive drop across the two sections.

As shown earlier, if K is a constant, depending on the frequency and conductivity of the disk and also, in the present case, the ratio between I and I_m (*i.e.*, the ratio between N_a and N_b), then, assuming I to be unity, $T = K I_m I_s$, and $I^2_m + I^2_s = 1$; therefore $T = K I_s \sqrt{(1 - I^2_s)}$, where I_s may vary from 0 to 1.

That the torque should be a direct function of the current taken by the shunt may seem paradoxical, since the latter might conceivably be external to the instrument, but it must be remembered that the ohmic drop across the magnetising coil is practically nil, and that the inductive drop across the coil and, therefore,

the current flowing in the shunt, are functions of the flux induced in the shunted pole. The intimate relationship between torque and shunt current is thus apparent. In fig. 7, a curve showing values of the torque T for various values of I_s, it will be noticed that the torque rises to a maximum at $I_s = .707$, and further, that at $I_s = .866$, the slope of the curve is 45° in a downward direction for rising values of I_s, that is, with this degree of shunting, 1 per cent. rise in the shunt current is accompanied by a 1 per cent. fall in torque and *vice versa*.

That this exceedingly useful characteristic makes it possible to design an induction ammeter which is free from frequency and temperature errors over a very wide range will be apparent from the following considerations:—

The torque on the disk of an induction meter depends on the production of eddy currents in the disk. The magnitude of these currents and, therefore, the torque, will vary with the frequency and also the conductivity of the disk.

The effect of an increase of frequency will be to increase the shunt current (by increasing the voltage across the winding) in just the same degree as it

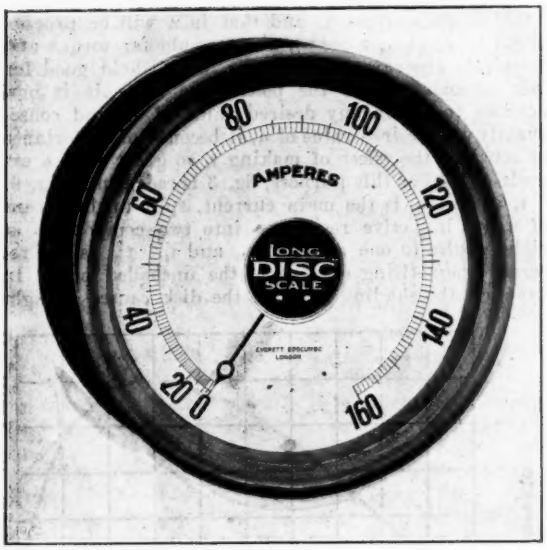


Fig. 8.

increases the magnitude of the eddy currents, by increasing the voltage induced in the disk. The net effect on the torque, therefore, will be zero. Similarly, a fall in the temperature of the disk, increasing the conductivity of the eddy-current paths and, therefore, the torque, will be counterbalanced by an increase in the conductivity of the copper shunt, causing an increase of the shunt current and *vice versa*.

In practice, an angle of 70° rather than 60° for a is preferable, since it gives a wider range on either side of the normal frequency and temperature over which automatic compensation may be obtained. The actual compensation curve is considerably flatter than is indicated in fig. 7, since there are two minor effects tending to minimise any variation of torque with frequency. The first of these is the presence of inductance in the eddy-current paths in the disk, which causes the impedance of these paths to increase with increasing frequency (and *vice versa*). This tends in a very slight degree to maintain the eddy currents at a constant value. The second effect is the shading of the unshunted pole by the disk itself. It is evident that this shading effect will vary in the same sense as the frequency, and the effect of increase of frequency on the position of the flux vector will be to bring it somewhat closer to that of the shunted pole, which is, however, itself already so heavily shunted as not to be materially affected by a small alteration in the shading effect of the disk. The slight decrease in the value of a thus obtained is also beneficial in counteracting the effect of changes of frequency.

Although ammeters only have been dealt with in this brief summary of the underlying theory of automatic frequency and temperature compensation, it is evident that voltmeters are amenable to similar treatment, and that, in the latter case, a nickel shunt, instead of the copper shunt previously considered, can be used with advantage to increase still further the rate of change of torque with temperature. The production of ammeters and voltmeters well within first-grade or even sub-standard requirements is, in fact, only a question of careful design of both the electrical and magnetic quantities and of the mechanical construction of the parts.

The writer is indebted to Messrs. Everett, Edgcumbe and Co., Ltd., for permission to publish the following details of a 50-cycle induction ammeter for 5 amperes, designed in accordance with the principles just enumerated, and, for comparison, similar data are given for a shaded-pole induction ammeter of the usual construction.

	Everett-Edgcumbe improved induction ammeter.	Typical shaded-pole ammeter.
Weight of moving parts ...	15 gm.	30 gm.
Torque for full-scale deflection	3 gm. cm.	2.6 gm. cm.
Torque/(weight)$^{1.5}$* ...	.052	.016
Volt-ampere consumption for full-scale deflection	5	7.5
Change of reading for a change of 10% up or down in frequency ...	0.2%	6.0%
Change of reading for a rise or fall of 10° C. in temperature	+0.3%	−4.0%
Change of reading after being left in circuit for 2 hours	0.5%	3.0%
Damping: seconds to come to rest	2.5	5
Error after three applications of 60 times full-load current	+1.0%	—

* For the arguments in favour of the factor torque/(weight)$^{1.5}$ instead of torque/weight, see the paper already referred to, page 555.

Fig. 8 shows the complete instrument, and attention may be directed to the openness of the first quarter of the scale, which is usually so cramped in an induction ammeter. It will be noticed that, since legibility at a distance is so important, particular attention has been devoted to the proportions and clearness of the figuring.

A Battery-charging Relay.

We have received some particulars of a device which has been adopted by the Oerlikon Co., Switzerland, in connection with the charging of accumulators. Its function is to disconnect the charging supply when the maximum end pressure is reached, and it is claimed to afford a means of ensuring the complete charging of the battery under any conditions without the risk of overcharging. The principle is based upon the fact that the accumulator, after attaining a cell voltage of 2.4 V at the commencement of gassing, always requires the same time to reach the full charge, the time constant being fixed by the characteristics of the battery. As the charging curve is fairly steep in the neighbourhood of the cell pressure of 2.4 V, the relay can be adjusted very accurately at that pressure. These conditions do not, however, obtain when the relay is adjusted for the end pressure, as the curve is then very nearly flat. When the charging relay comes into play, it brings a time relay into operation which can be set for a running-out time varying from half-an-hour to 2½ hours, according to the conditions of service. The apparatus is protected by a drip-proof casing. The running-out time can be adjusted without opening the cover.

Radio Battery Eliminators.

Some observations on the identification of suitable types, and the reasons that necessitate the exercise of care in their selection.

By PAUL D. TYERS.

THE recent article dealing with the results of tests of a number of radio battery eliminators* indicated very clearly that few manufacturers are agreed on the chief points of design. Since it is obvious that the battery eliminator has come to stay, it seems desirable to consider in detail the essential requirements and features of design which must be embodied.

Adequate "smoothing" is the essential feature of any substitute for a high-voltage anode battery, and can only be obtained by using sufficient inductance and capacity in the "smoothing" circuit, but it is a little difficult to fix any definite constants for such a circuit, as they are dependent upon the load which is to be taken from the eliminator and also the extent of the frequency range over which "perfect smoothing" is required. Many transformer-coupled receivers utilising horn loud-speakers will reproduce practically no frequencies as low as fifty cycles; obviously, then, a battery eliminator for use with such a receiver need not be made to achieve "perfect smoothing" at the lower frequencies, but the practice of producing any apparatus for broadcast reception which will not function properly over the entire useful frequency band is strongly to be deprecated.

No doubt those manufacturers who produce eliminators which do not function at the low frequencies have in mind the all-important item of production cost, because correct "smoothing" at the low frequencies naturally calls for larger condensers and chokes. Since, however, there is a general tendency towards the attainment of better amplification and loud-speaker reproduction, a battery eliminator, in the writer's opinion, is of little value unless it operates without appreciable hum off a 50-cycle input circuit in conjunction with a good receiving set and a cone speaker. As an example of inadequate "smoothing" at the low frequencies, a popular eliminator may be mentioned which gave practically no hum with a small horn speaker, but made a fifty-cycle ripple audible twenty yards from a cone speaker worked by the same set. When considering either the design or purchase of an eliminator, tests should preferably be made under the desirable conditions mentioned above.

The type of "smoothing" condenser employed in an eliminator is a very important point to bear in mind when estimating the life of the instrument. Size and production cost necessitate the use of paper dielectric condensers and, unless they are of very good quality, breakdowns are liable to occur. In the case of the majority of eliminators, the voltage applied to the first bank of "smoothing" condensers is of the order of from 200 to 230 V on peaks and, accordingly, it is unwise to use anything less than a 500-volt d.c. test condenser, although fairly satisfactory service may be obtained from a 300-volt test condenser. Traders would do well to investigate this point before assuring their clients that they may expect long service from their instruments.

Without the aid of a very high-resistance voltmeter, it is somewhat difficult to measure the output voltage when the eliminator is actually on load. Inspection of a number of output curves of popular eliminators shows that very many give far too low a voltage on a useful load; therefore, before deciding on the purchase of any particular instrument, it is advisable to ask the makers to furnish details of the terminal voltage at various loads, for it is obvious that if this becomes too low, all the valves will distort, since they will then not operate on the correct portions of their characteristic curves. There is no difficulty in determining the required output for any given receiver; for example, if the receiver utilises two valves taking 3 mA and one valve taking 4 mA at an anode voltage of 120 V, then a satisfactory eliminator which will deliver 10 mA must have a terminal voltage of at least 120 volts. It must also be remembered that the fluctuating voltages due to the signals will cause the nominal steady total current to vary, and therefore, as a safe rating, the eliminator in this particular case should still deliver approximately 120 volts when the steady current varies by at least 30 per cent.

The greatest difficulty which is likely to be experienced with an eliminator is that due to oscillation at a very low audio-frequency, which defect is more usually found when the eliminator is used with a resistance-coupled set. The normal type of "smoothing" circuit is a simple π filter consisting of two condensers, one on each side of an inductance, and the latter therefore form a resonant circuit which is liable to be set into a state of oscillation. An eliminator which is provided with only one positive terminal cannot be used with a three-valve resistance-coupled receiver. When, however, an intermediate terminal is provided, the detector valve can usually be operated from this tapping and the remaining valves at the full voltage. Whether this method is successful or not depends upon the manner in which the intermediate voltage is obtained. Broadly speaking, a separate resistance, or sometimes a choke, must be connected between the full-voltage tapping and the intermediate one; further, a shunt condenser must not be placed across this resistance, or choke, either in the eliminator itself, or in the actual receiver. The bypass condenser from the intermediate tapping must be connected directly to earth. As a general rule two consecutive resistance-coupled stages may be connected to a single tapping. This means that a four-valve resistance-coupled set can be operated from a suitably connected eliminator with only one intermediate tapping, without any trouble arising from oscillation. Actually, then, the trader must have a knowledge of the internal connections of both the eliminator and his client's receiver before he can decide upon any particular instrument. If it is found that there is a condenser in the receiver connected between the two high-voltage tappings, it should be taken directly to earth; also, if only one high-voltage tapping is provided, the eliminator can be used by providing an additional tapping on the set, either for the first valve in the case of a three-valve receiver, or for the first two in the case of a four-valve set.

If the important points which have been dealt with above are given due consideration, the trader should have no difficulty whatever in selecting a battery eliminator which will give his clients every satisfaction. It is essential to remember, however, that any type of eliminator is not necessarily suitable for any particular receiver, which fact, of course, is due entirely to technical considerations, and an unsuitable eliminator must not be assumed to be of inferior design or manufacture.

* "The Power Supply of Wireless Sets," ELEC. REV., June 10th, 1927.

The Profits of Electricity Supply Undertakings.

By making a large profit an undertaking not only excites the cupidity of the Finance Committee, but also incurs additional burdens in the shape of income tax and local rates, which must be paid by the consumers.

By "ACCOUNTANT."

CRITICISM is from time to time levelled in some of the technical journals at municipally-owned undertakings that their net profits have been reduced over those of former yars, the inference, of course, being that the undertaking is not in such a healthy financial condition unless the available surplus reaches some fantastic figure previously obtained. Putting aside the question of earning large surpluses for the relief of local rates—a thoroughly bad principle and one which it may be reasonably assumed is not in the minds of these critics—and also assuming that the reduced profit available is not due to a substantial increase in the working costs—it is not a little surprising that, after more than 30 years' experience of municipal electricity supply accounts, the very doubtful advantages of large profits have not been more generally realised.

In general, it may be assumed that the object of obtaining any surplus over and above the actual cost of production is to create a reserve fund, and it seems desirable to examine the purposes for which the reserve fund may be created, and whether its existence is justifiable. Before doing so, however, attention must be drawn to the fact that before any surplus is arrived at, two very important deductions, *viz.*, income tax and local rates, each of them dependent upon "profits," must be taken into consideration. Little comment is necessary on the first of these items, *viz.*, income tax; it is unlikely that any local authority is desirous of imposing burdens on its consumers in order to hand over a portion of its surplus revenue to the Inland Revenue Commissioners. Regarding the second, *viz.*, local rates, some explanation may be necessary, as it may not be generally realised that the usual method employed to arrive at the valuation of a revenue-producing undertaking, such as electricity, is that known as the "revenue" principle. An attempt is made by the local assessors to arrive at an annual value or rent which a hypothetical tenant would be likely to pay, and from the total revenue of the undertaking is deducted only such portion of the expenditure as would be normally incurred by this hypothetical tenant. What may be assumed to be landlord's repairs to machinery and plant, law expenses, expenses connected with loans, items of capital expenditure charged to revenue, and interest and sinking-fund charges, are not allowed as expenditure for deduction, and the resultant figure, after a further allowance has been made for interest on tenant's capital, profit, &c., becomes the valuation of the undertaking. It will be seen from the foregoing, therefore, that the valuation will be higher than it should be if the revenue actually raised in any year is more than is really necessary to meet the total cost of production; and the high valuation of any one year will affect succeeding years until a revision of the valuation takes place. Too much stress cannot be laid upon the importance of this question of rating and valuation and the earning of large surpluses to the engineers of electricity undertakings, as it is extremely unlikely that any helpful aids towards relief in this direction will be obtained from the Finance Departments of local authorities. A borough treasurer, faced with the constant difficulty of keeping down local rates to a more or less standard figure year by year, will naturally find his task more easily accomplished by extracting large sums annually from the local trading undertakings, fr m which only some mild protest may be put forward, and to which it is easy to retort that the remedy lies in their own hands, than to impose additional burdens on the general body of ratepayers, whose voices will be in evidence at the forthcoming elections. It will be appreciated, therefore, that the avoidance of large surpluses is one way in which the undertaking can maintain its cost of production at a minimum figure so far as local rating is concerned. The burden of interest and sinking fund must also not be lost sight of in this matter, as the heavier the service of debt charges, the more revenue will require to be raised to meet the expenditure, and consequently the higher the valuation of the undertaking under the "revenue" principle.

Reverting now to the question of the reserve fund, the creation of a fund of this nature is optional on the part of the undertakers. The object of the fund is to meet—

> "any deficiency at any time happening in the income of the undertakers from the undertaking, or to meet any extraordinary claim or demand at any time arising against the undertakers in respect of the undertaking."

It would, therefore, appear that the reserve fund is not available to meet new capital expenditure, and the question may quite legitimately be raised whether the building-up of a reserve fund to anything like 10 per cent. of the aggregate capital expenditure as provided for by the Electric Lighting Clauses Act, 1899, is warranted, especially in the case of the larger undertakings, with capital outlays of from £2,000,000 to £10,000,000. It may be safely argued that there is no need of a reserve fund of this size to meet ordinary annual deficiencies. The amount at which the reserve fund should be stabilised is a matter entirely dependent upon local conditions, having regard to the possible obsolescence of plant before the expiry of its estimated life, and the maintenance of the fund at this figure should be a charge on the revenue of the undertaking. Any surplus of the reserve fund over and above the agreed figure could be profitably applied to the writing-off of outstanding capital debt of the undertaking, thus redûcing the burden of interest and sinking-fund charges for future years, with consequent benefit to the consumer.

To sum up, therefore, it may be claimed that the making of large profits is not the standard by which the soundness or otherwise of the financial policy of an undertaking should be judged, inasmuch as they add to the burden of income tax and local rates; and the creation of a reserve fund up to its maximum capacity is in general not necessary to meet the ordinary annual deficiencies that may occur in the working of the undertaking.

The Travelling Representative.

The Outside Salesman Considered from an Inside Standpoint.

By A. J. SMITH.

GROWING appreciation of the importance of salesmanship in the highly competitive field of business to-day has caused much attention to be devoted to the qualities which go to the making of a successful salesman, but not so much to the influence which the efforts of the growing army of salesmen have upon internal work and administration.

Qualities.

As a general rule, it will be found that it is the successful type of outside salesman who requires the most careful handling and control at headquarters. The painstaking, methodical, and systematic mind which is evidenced by regular and businesslike reports, from which no essential detail is omitted and which can be handled with the minimum of trouble at headquarters seems rarely combined with the possession of selling abilities of any startling order. On the other hand, the brilliant salesman is often an erratic individual who, though he secures orders in adequate volume, is apt to be careless in his methods of business, sparing in the details he vouchsafes either of his negotiations or arrangements, and often far readier to take a 50-mile journey than to pen a 50-line report.

Reports.

Considering the difficulties which are encountered in almost every trade in the endeavour to secure increasing business, it is inevitable that with most travellers the reports will vastly exceed the number of orders. It is the practice with certain firms to endeavour to follow up each reported call with a letter in which additional information is given upon some aspect of the business discussed, which amplifies some explanation, or confirms some verbal quotation of discount or price. The letter has the effect of again reminding the prospective customer both of the representative and the house he serves. Although an excellent plan in theory, its practicability depends both upon the class of business transacted and the number of calls which the traveller makes per day. One may occasionally encounter the travelling representative who, in a large centre, will make between thirty and forty calls each day, and the dispatch of a suitable personal letter to each of the firms visited, unless the procedure is allowed to degenerate into the dispatch of a stereotyped form is likely to occupy the best part of a typist's working day.

It is another feature of this subject that—in the engineering trade at all events—it is precisely those representatives who send home the fewest orders who are the most prolific in reports and calls. It is a very natural failing in such cases that most of the reports are apt to be so worded as to give the impression that the calls represent very "live" inquiries. In such circumstances the amount of clerical work which has to be devoted to the task of keeping pace with these is totally disproportionate to the results obtained. There is, on the other hand, in connection with the sale of machinery or technical articles where negotiations are usually spread over a prolonged period, a real danger in neglecting to confirm the representative's negotiations at various stages, as the omission may have a serious effect in the event of any dispute arising later where the customer's memory of what has been arranged is at variance with the traveller's statement of the position.

Prolific Inquiries.

One of the great drawbacks which attach to engineering salesmen is that far too many of the inquiries received through their instrumentality bear signs of having been originated by the ingenuity of the salesman rather than by any expressed need of the customer. As a typical example of what happens might be cited the case of the engine-building firm who may regularly receive from one representative from half-a-dozen to a dozen inquiries per day, all of them calling for detailed tenders to be submitted to the customers named for engines of different sizes, the price to include delivery and erection upon foundations to be put in by the maker, with oil-storage equipment, pipe lines, cranes, and general engine-room equipment, with guarantees of performance, and occasionally requiring an offer to be made for an existing plant.

As a general rule, the amount of work which has to be put into the preparation of these tenders called for in such numbers is in inverse ratio to the prospects of business resulting, and though the requests are colloquially termed "inquiries," they are often to be regarded as suggestions of the salesman perfunctorily agreed to by the customer rather than any real request for information from the latter. Experience will show that an inquiry is seldom a "live" one without some definite communication direct from the customer.

Orders.

In many cases it is usual for the orders secured by a salesman to be written out by him in a representative's order book and posted on to the makers for execution. Sometimes the order may be countersigned by the customer, but more frequently it is not. Sometimes the order may be confirmed by the customer dispatching his own official order, but very often this is omitted, so that at a later date when the customer's memory of the arrangement may differ from what is set forth in the salesman's own order, there are grounds for an interesting and expensive legal action. In the case of all salesmen's orders, it is a wise precaution for nothing to be done before a letter of acknowledgment and thanks has been sent to the customer direct, giving an exact copy of the order as it is being entered in the books, the copy being especially clear in regard to price, discounts, time of delivery, and terms of payment. This is an elementary precaution, but one which would save many legal actions and a still greater number of disputes which are settled before they reach the courts.

References.

There is in many establishments a tendency in the case of salesmen's orders to neglect such ordinary precautions as obtaining references or making inquiries respecting the customer, reliance being placed upon the representative not to forward business which is in any way unsafe. Though the trust may not be misplaced upon many occasions, it is certain that many bad debts would be avoided if precisely the same procedure were taken with regard to salesmen's orders as for a chance order received through the post. That is, if the customer is a new buyer, references should be asked for and independent inquiries made. No economies are likely in the long run to prove more costly than those which have for their object the saving of a shilling or two which would have to be spent upon status inquiries respecting a new customer, and such economies should be definitely discouraged.

Remuneration and Control.

The method of remuneration has a profound effect upon the relationship of a salesman with his house. It is usually possible to exercise a greater measure of

control over the salesman working upon an outright salary basis than it is with one working merely upon a commission basis. In the former case, if a journey has to be taken or work done, the salesman is instructed to do it, and the instructions are acted upon. The salesman working upon commission cannot be instructed in the same way. As a business man, he expects that the time spent on any proposition must show a definite or, at any rate, a very probable return, and he is consequently apt to exercise his own judgment before acting upon instructions. To define the position shortly, a salaried representative can be definitely instructed upon his duties, but the commission man has to be advised and persuaded!

Evening Classes: An Inquiry.

A constructive criticism of the average electrical engineering curriculum of technical schools and colleges for evening-class students.

By A TEACHER.

AT this time of the year* the teachers of evening classes must be taking stock of the work of the session, preparatory to the revision necessary in view of the various examinations which are the culmination of the year's work.

This revision must to some extent sadden the heart of an ardent teacher. Once again there will be brought home to him the fact that so little ground has been covered, and of that so little retained. Two questions will probably arise in his mind: are evening classes worth while? How can they be improved?

As evening classes are the only means of directed technical education available to a large body of potential electrical engineers, they should be of interest to more than the people immediately concerned. They have been the training ground of many who have climbed high in the profession, and they absorb a good deal of public money; so all who have the future welfare of the nation at heart should be interested in their development. The purpose of this article is to review certain of their phases with a view to stimulating that interest, so that as a result of inquiry, evening-class work may be imbued with higher ideals and greater efficiency.

Let us look at the work of a medium-sized college. We say that very little ground is covered in the session, but if we look at the curriculum we ask what more can be done. The students are at the college three evenings per week. Two evenings are devoted to electrical work, often one theoretical and the other experimental, and the third to mathematics. Homework will probably be given out at each of these classes; let us assume that this takes up another evening.

This homework is in many respects essential. It helps the student, although he does not realise the fact, to consolidate the position gained by hearing the lectures. It urges him (if it *compels* him, it is in the best sense a failure) to do work outside college hours. It enables the teacher to see how much of the subject the student has grasped.

Of course, teachers tell their classes that if they cannot do more than the college lectures they will never get far; this is true, but can one expect from growing minds and bodies more than four evenings of study, remembering always that in most cases the students have done a day's manual work beforehand?

Even under these conditions it takes about five years to reach approximately the standard of the City and Guilds final. No mention has been made of the study of allied subjects— mechanical engineering, chemistry and physics—or of the time required to retain the general education previously acquired; nor has time been allocated for serious news and technical paper reading, for the older students.

It does not appear from a glance at the whole as though educationists have neglected using any of the available free time of the average student.

Grouped courses are the order of the day, if the head has his way; but, while students start thus, many soon depart from this well advised plan. In order to gain another evening—often to further their electrical knowledge—they drop the mathematics class.

This seems a deplorable fact. But is it so? Let us look at the mathematical knowledge of the student. He will talk of what he has done—of calculus and *dx's* and *dy's*—but ask him to do a simple transposition of formulæ, or a long simple calculation, and you will find that even if it is accurately done it has been a laborious effort. The teaching of mathematics does not seem to be as efficient as it should be.

The writer is not one to belittle either the value or the desirability of the higher mathematics, but he would say "first things first." He would urge a more thorough grounding in simpler work. Simple arithmetic and algebra should be quickly and accurately done. Many valuable hours are wasted in the electrical classes through this deficiency. After all, transpositions of formulæ, algebraic equations, and simple trigonometrical relationships will carry the student a long way—in many a case, as far as his mentality will permit of.

Give them a long problem and they will work away and eventually produce an answer which is, or should be, obviously ridiculous. They never seem capable of mentally working out an approximate answer. So it seems as though, while they are capable of doing certain set sums, they do not acquire a mathematical mind as a result of their studies. This is a serious defect—a weak link in the chain of evening classes.

Their mental attitude towards mathematics may be judged from the following example. A class of fourth-year students possess between them Kemp's, Cotton's, and Maccall's text books, which have either been given or recommended to them. All of them prefer Kemp to the other two. Inquiry elicitates what was guessed, namely, that the mathematical treatment of Cotton and Maccall frightens them.

The standard of the general education of the majority of evening-class students is very low. One result of this is that their minds lack plasticity. Of literature and the arts they know but little, and care less. Their view of life is very bread-and-butterish. At twenty-five they do not read the newspapers seriously. Try to discuss tariffs with them—it will soon be seen that they know little of money matters. How a company or a corporation raises capital is to them a mystery. Interest, depreciation, and redemption are as words from a foreign tongue.

It will be to the common good when the leaving age for the elementary schools is raised, and when more secondary and commercial schools are available. They will use wisely money at present wasted on technical education.

The writer is of the opinion that a few hours devoted to special aspects of general education will be well

* This article was received in March.—EDS.

spent. Why not have a lecture on the life and labours of Faraday as a prelude to electromagnetic studies? Why not give older students a lecture on simple finance, or one on the place and proportionate worth of technical knowledge in commercial engineering? Both of these have been dealt with in the I.E.E. *Journal*—why not "bovrilise" those papers and give them to the students? In what is perhaps their last year a night might be devoted to a discussion on the place and purpose of engineering in life.

In view of these disabilities the electrical work proceeds as well as is possible. The greatest difficulty here is that they will hang on to a series of facts instead of trying to grasp a principle. If only they can lay hands on a formula they are in their seventh heaven. Ask them to use it a few weeks later, and they will have forgotten whether the answer given should be in farads or microfarads, or whether p stands for the number of poles or pairs of poles.

Very few students can interpret correctly notes made but a few weeks before, and they have an abhorrence against using a page for a vector diagram or a diagram of connections when any odd corner is available. So, if careful supervision is not maintained, revision will have to be synonymous with reteaching.

So much for the mental aspect of evening classes; let us turn to the physical side of the students. It should be remembered always that they come to the classes in a tired state. This does not mean that they are exhausted, but after a day's manual labour they often fall victims to drowsiness when seated in a warm room. It is amusing to the man, but annoying to the teacher, even though excusable, to see a row of nodding heads.

Again, the home environment of a student is often unfavourable to mental work. In most homes active life is confined to one room. A potentially doubled lighting and heating bill is a deterrent to solitary study.

The equipment of most medium-sized colleges is anything but ideal; what machinery there is was cast overboard by Noah in his endeavours to survive the flood. This means that the number of experiments is limited; but there is a worse thing than this: that is, the serious inaccuracy of the results obtained. You may tell the students in the theory class that a certain efficiency should be about 90 per cent., but in the practical test an efficiency nearer 50 per cent. is obtained. This is due to the combination of machine senility and the inaccuracy of the testing instruments. So the teacher has to be full of explanations and apologies, with the result that the student loses faith and interest in the proceedings.

The remedy here is pretty obvious. If only committees would realise that it is false economy to run an ill-equipped class, this state of affairs would quickly cease. If the money cannot possibly be granted, it would be better to close down completely. But no—committees like to say they provide facilities for study—facilities which really do not exist.

Having briefly reviewed the defects of evening class work, certain remedies for them will be apparent. It would obviously be better if more day-apprentice courses, or sandwich-system courses, were substituted for evening classes. This is largely being done by the big firms, but does not help the lad employed by a small firm.

A high standard of general education is necessary if the student is to benefit as well as he should by the tuition. What has been gained at the elementary school should be maintained. Teachers should urge the study of the literary and commercial pages of the newspapers, especially among adult students. They should also give a bird's-eye view of the course before detail work is commenced. In the higher classes students should be taught the commercial aspect of the subject, and that life means more than the acquisition and use of engineering knowledge—that the latter is to be the means and not the end.

It may be that some will think that evening classes are a waste of money and that they should be swept away. They may think that this article tends to this view: it does not. Its purpose is to point out weaknesses in this educational link and its endeavour is to suggest improvements.

The first year generally starts with a full complement of pupils, many of them serious students of great potentiality, although, alas, many present themselves because their fathers make them do so. These, and the don't-like-work's, soon fall out, and of those that present themselves for a second year one can say that the majority are worth spending trouble on. Many stay year after year, and attend regularly. What praise can one give to students who, despite many handicaps, some of which have been enumerated above, attain to the level of the City and Guilds final? In spite of certain weaknesses they possess courage, ability, and serious purpose. From the raw material they have forged themselves into a shape which circumstance could quickly mould into young technical engineers—an asset to themselves, the industry, and the nation. By what medium? The only one available—the evening class. There can be but one verdict. The evening class must be continued, only in a better form.

The Delivery Problem.

The importance of fully giving the necessary data and information to assist the manufacturer in carrying out the order.

By ROBERT MARSDEN, M.M.A.E.

WHAT period of time should elapse between the placing of an order and the delivery of the equipment to the purchaser? Naturally this depends largely upon the type and size of the equipment ordered, but it is frequently found that the purchaser delays ordering until the last minute, and then expects delivery within an impossibly short period.

Unless the order happens to be for stock equipment, so as to understand some of the difficulties under which the manufacturer works, it is necessary to consider whether the order covers every essential detail. Almost invariably the type of motor, speed, voltage and switchgear are indicated, but often the pulley dimensions are "to follow." Now this omission seems of small moment, but when it is realised that the lack of this information means loss of valuable time in the foundry, its importance becomes obvious.

If the motor is required to drive through wheel or chain gearing, it is essential to state the bore and keyway where anything other than a purely standard shaft end is required, for without this the works cannot put in hand the armature or rotor shaft. This remark applies also to the half-coupling of a motor shaft that is being directly coupled.

Omissions like those mentioned above result in the loss of much valuable time to the manufacturer by his having to await further instructions and to issue extra orders covering the same equipment. Thus the works' routine is frequently disorganised, and in order to give delivery in the time required, overtime may have to be

worked—an expense which can rarely be charged to a client. With the keen competition at present prevailing, it is possible to lose practically all the profit on an order which has to be dealt with under such conditions. Where urgent delivery is essential, little details such as those indicated mean everything to the manufacturer.

This leads to another important point. Where equipments have to be delivered outside the larger towns, the addition to the delivery instructions of the name of the railway company and the nearest railway station would considerably minimise delay in transit.

On the other hand, much difficulty is often experienced in cases where no definite date for delivery is specified. For instance, where equipments are required for erection in a new building, obviously no good purpose would be served by delivering them weeks before the building is ready to receive them, thus exposing valuable plant to the ruinous effects of damp, cement, dust, and so on. Furthermore, payment is usually made within thirty days from the date of dispatch, and it is only reasonable for the purchaser to desire to test the plant before meeting the invoice.

It is always advisable to prepare a schedule of delivery where several equipments are required for one contract. This can then be forwarded to the maker so that he may know in which order to commence manufacture. In these cases always have a reference number for each equipment, otherwise it is an easy matter for the men on the job at the time of delivery to unpack two or more equipments and have all the motors and switchgear mixed. There may be two motors of the same horsepower, but with different windings and control gear, and it is in a case of this description that the reference system is invaluable.

When dealing with directly coupled units, make sure that if delivered coupled together they can be conveniently handled on site, and will pass through all the doorways, &c.; thus obviating the necessity of uncoupling and re-assembling.

The return of empty packing cases should be attended to immediately after delivery has been effected, as their non-return creates much annoyance and friction between all parties concerned.

The common idea that delivery depends entirely upon the manufacturer is one which cannot be too strongly denied. He can only work to instructions, and is frequently unacquainted with the actual site upon which the equipment is to work. Co-operation between purchaser and manufacturer is imperative for smooth working and speedy delivery.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

The Summer Recess.

Parliament rose for the summer recess on July 29th, and will reassemble on Tuesday, November 8th.

Central Electricity Board.

On July 20th, Mr. ROBINSON asked the Minister of Transport how many meetings had been held by the Central Electricity Board; and when it was anticipated that the first scheme would be submitted.

Colonel ASHLEY said that the first scheme was published by the Board on May 11th. After consideration of the representations which had been made, the scheme was adopted as modified by the Board on June 29th, and published in accordance with the provisions of the Electricity (Supply) Act, 1926, on July 1st. He had no information on the point raised in the first part of the question.

Royal Assent.

The Royal Assent has been given, by Commission, to the following Acts:—Bognor Gas and Electricity, Hastings Tramways Company (Trolley Vehicles), Wessex Electricity, East Anglian Electricity, County of London Electric Supply Company, and London and Home Counties Joint Electricity Authority (No. 2).

Special Orders.

Special Orders have been approved relating to parts of the rural districts of Guildford and Hambledon, Surrey; parts of the rural districts of Newton Abbot and Totnes, Devon; the borough of Scarborough, the urban district of Scalby, and the rural district of Scarborough, North Riding, and the urban district of Filey, East Riding.

Beam Wireless.

On July 26th, Sir W. MITCHELL-THOMSON, Postmaster-General, informed Mr. Day that the contractors hoped to be in a position soon to hand over the stations for the Anglo-Indian beam service for the official test, but they were unable yet to fix a date.

Legal.

British Thomson-Houston Co., Ltd., v. Metropolitan-Vickers Electrical Co., Ltd.

IN the House of Lords, on July 29th, judgment was delivered by Lords Dunedin, Sumner and Blanesburgh in this case, which was an appeal from a judgment of the Court of Appeal in an action of the respondents brought for the purpose of restraining the appellants from alleged infringement of their patent granted in 1912 to Emanuel Rosenberg for an invention of improvements relating to synchronous dynamo-electric machines. Mr. Justice P. O. Lawrence found the patent to be invalid, but the Court of Appeal took the opposite view, and held it to be valid, but both Courts decided that there had been infringement. As a result the British Thomson-Houston Co. appealed to the House of Lords, submitting that the Court of Appeal was wrong in holding that the patent was valid. The writ was issued in 1915, but the hearing did not commence until 1924.

Lord DUNEDIN, delivering judgment, said he did not think that anyone who was confronted, as Rosenberg, with the difficulty of getting a heavy machine into synchronism, and troubled with the too great consumption of current if the synchronised motor were turned on at once, and who, looking over older specifications which had to do with such machines, had come upon Tesla's specification—he did not think that such a man would have been in the least likely to think that the solution of his problem had been provided for him. True, he would, in the drawings, have seen two machines in series, but the reason suggested for that would have been the idea of getting both machines at work, and there would have been no indication, or even hint, that the series arrangement, with properly proportioned machines, got over the difficulty of securing proper synchronism. He was, therefore, of opinion that Rosenberg's patent was not foreclosed by Tesla. That opened the question of infringement. The appellants' argument was that there was not infringement because the machine did not work, as did Rosenberg's, by one operation, but required two. And, further, he said that the device of the choke coil was an independent device distinguishing it from the Rosenberg method, which had no such device for that purpose, *i.e.*, for the actual attainment of synchronism. Rosenberg did mention a choke coil, but that was for the purpose of not shutting off the starting motor too suddenly and giving too much of a shock to the synchronous motor. As regards the first of these arguments, it was, he thought, clear that you could not avoid infringement by taking a patented machine and then making it work a little worse than it naturally would, and then remedying that by another device, and that was just what the defendants had done. They had made their starting motor in such a fashion that, being in series with the synchronous motor, it would work up to the appropriate speed, but would not always or invariably pass enough current to allow the synchronous motor to make that last effort which ensured synchronism, and then they remedied that defect by introducing a common electrical device, a regulated shunt, to give the synchronous motor just that extra current which it required. The law as to infringement of combinations was well settled. Of course, if the infringer took the combination lock, stock and barrel, there was no question, but it was very easy to modify a combination, and the modification might be effected by either addition or subtraction. The question for the Court was not that of detecting absolute similarity, but was that of seeing whether the pith and marrow of the combination, to use Lord Cairns's phrase, had been taken, and if that had been done there was an infringement in spite of any modification. He was, of course, excluding the case where a modification had patentable matter in itself. Now, applying that criterion, he had no doubt that the pith and marrow of Rosenberg had been taken in this machine. There was the series connection; there was the avoidance of too great a current passing to the synchronous motor *in initio;* there was the shielding effect of the starting machine; there was the gradual transference of voltage; but just because the starting machine had been designed with such a resistance in its armature that it would not always or invariably pass sufficient current to allow the

synchronous machine to get into synchronism, there had been added a common device to get over that difficulty. That, in his view, left infringement just where it was, and he was, therefore, of opinion, along with the trial Judge and the Court of Appeal, that here there was infringement. The appeal should be dismissed with costs.

Lords Sumner and Blanesburgh agreed.

Breaches of Factory Act.

AT Blyth Police Court, on July 26th, there was a sequel to an accident by which two workmen received a severe electric shock while moving a circular saw at the Blyth Import Dock on June 7th, when Messrs. Reichwald, Ltd., had four charges preferred against them under the Factories Act. Only one was investigated. A Bedlington hawker, named Benjamin Jennings, who was standing near the bench at the time, received a fatal shock. The evidence showed that there was leakage from the cable, as a result of which the circular saw had become "live." Two workmen, William Wells and Edward Nobbs, who were rendered unconscious for a time, were revived by the application of first aid by the foreman, Alexander Lilley. Lilley cut the current off by hitting the switch with his cap. Both workmen stated that they had been given instructions that they were not to remove the saw unless the current was switched off. The Bench imposed a fine of £5.

Claim Against Carlisle Corporation.

The Times reports that after a hearing of five days at Carlisle Assizes, Mr. Justice Finlay, on Saturday last, gave judgment against the Carlisle Corporation in an action brought by a property owner named Dudson, in front of whose houses a retaining wall collapsed while electricity cables were being laid. His Lordship held that the Corporation had been negligent and could not recover from Mr. Dudson the cost of rebuilding the wall.

Marconi's Wireless Telegraph Co., Ltd.

MR. JUSTICE EVE, in the Chancery Division, on July 29th, directed that the petition for the confirmation of the reduction of this company's capital should be heard on November 7th next.

Business and Industrial Notes.

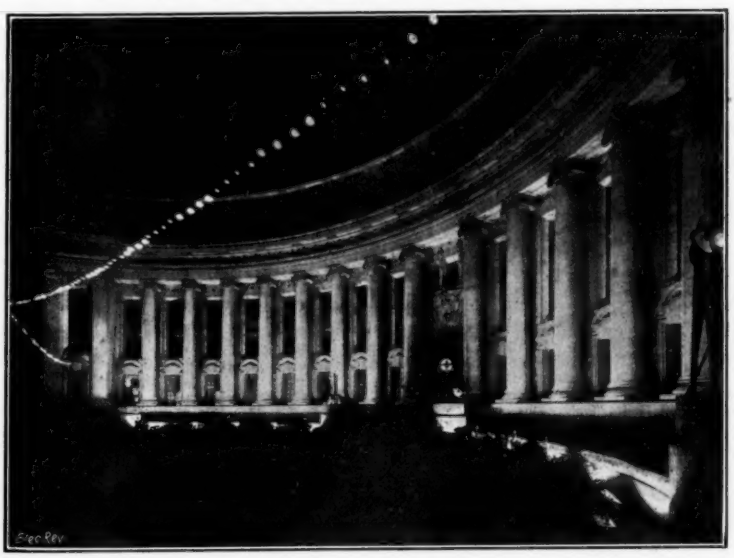
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The "C.E.D.A.C." Campaign.

Sets of working programmes for the E.D.A. Circle Campaign, which was dealt with in our last issue, are now being sent out in a special folder to supply undertakings, contractors and others. The director and secretary of E.D.A. (Mr. J. W. Beauchamp) urges all concerned to get to work at once to ensure the success of the campaign.

The London County Hall Floodlighted.

On the occasion of the reception of the chairman of the London County Council on July 22nd, an effective display of flood lighting was used to throw into relief the fine architectural features of the centre portion of the building. The effect from the north side of the river was eminently successful and was achieved by the use of 18 kW of gasfilled lamps of 1,000 and 500 W respectively, installed in suitable fittings loaned for the occasion by the Electric Lamp Manufacturers' Association, whose engineers, Messrs. Jones and Lingard, assisted the Engineering Department of the Council in designing the scheme and putting it into operation.



Flood-lighting of the London County Hall.

The A.E.G.'s Forty Years.

The Allgemeine Elektricitäts Gesellschaft, Berlin, recently celebrated the completion of the fortieth year of its existence, the company having been formed in 1887 to acquire the business of the German Edison Co. for Applied Electricity, organised in May, 1883, with a capital of £250,000.

New French Company.

A new company has been formed in Paris (20, Rue de Petrograd) with a capital of 300,000 fr., and the title La Société de la Lampe Zenith, to manufacture electric lamps and radio valves.

United States Electrical Exports.

The preliminary statistics of the United States foreign trade during May last show that there was a rise in the value of electrical exports. The total was $8,835,563, as compared with $8,681,958 in April and $7,464,898 in May, 1926. Although in comparison with the corresponding month of last year there was thus a rise of $1,371,265, only 35 classes out of 67 registered increases. One of the greatest rises occurred in insulated copper wire and cable, from $501,873 to $671,017; radio apparatus rose from $443,981 to $606,233; a.c. generators, 2,000 kVA and over, from $6,672 to $250,035; motors under 1 h.p. from $151,998 to $228,613; transforming and converting apparatus from $337,164 to $469,038; searchlights and projectors from $20,645 to $115,995; and motor-driven household devices from $150,981 to $197,521.

There was a large fall in the value of exported steam turbo-generator sets—from $214,408 to $19,331. The majority of the decreases were not of very great proportions, the next largest being about $70,000 in the case of starting and controlling equipment for industrial motors. Declines were recorded for carbon furnace electrodes, electric lighting fixtures, switches of over 10A and switchboards, ignition apparatus, electrical porcelain, &c.

Canada remained the most important customer, her share amounting to $1,932,169; Australia was next with $856,232. The British Empire, as a whole, took goods valued at about $4,000,000—approximately 40 per cent. of the total. This country's share was $690,691, and it is reported that "remarkable advances are being made in the United Kingdom."

The imports of electrical apparatus into the United States during May were valued at only $315,990, about half of this being represented by "other electrical machinery and parts." Radio apparatus was second in the list, and it is stated that most of this came from the United Kingdom. Switzerland ($109,502) was the principal supplier of electrical goods as a whole, and Great Britain ($92,855) the second.

Tilmanstone Colliery Ropeway Approved.

On July 27th, the Railway and Canal Commission, presided over by Mr. Justice Sankey, approved the scheme of the Tilmanstone Colliery (Kent) proprietors for the installation of an aerial ropeway from that colliery to Dover Harbour, a distance of seven miles.

An F.B.I. Forecast.

The forecast of the Federation of British Industries for the third quarter of 1927, states that the normal seasonal slackening in trade which is in progress is being accentuated by the fact that it coincides with the conclusion of the working off of the great bulk of the accumulated orders left over as a result of last year's stoppage. So far as a revival of trade in the autumn is concerned, it is hard to find any solid ground for optimism. It is difficult, for example, to see how either the heavy constructional industries or the staple export trades can advance much above their recent peak in the absence of some marked change in the present trend of international monetary movements and a substantial strengthening of our own Central Bank reserves. The hopes held out that the reduction of the Bank Rate to 4½ per cent. in April marked the close of the long drawn out period of credit restriction, with its consequent fall in the price level, and the beginning of the much needed expansion in the basis of credit have failed to materialise. A rise in the Bank Rate to at least 5 per cent. in the autumn now seems inevitable, even though exceptional steps are taken by the Federal Reserve Banks of America to relieve the autumn strain.

A Leeds Wiring Dispute.

At last week's meeting of the Leeds City Council a proposal by the Tramways Committee that the electrical wiring of the extension to the Swinegate depôt should be done by the Department was objected to. A member of the Council said that the contract for the whole job awarded to Messrs. Wright included the items specified, and he considered that Messrs. Wright were entitled to the profit even if they did not do the work; he therefore moved that the proposal should be referred back to the Committee. An alderman maintained that as the Department could do the work, there was no need to bring in a sub-contractor. In other departments direct labour was employed. Eventually the amendment was defeated, and the Tramways Committee's minutes were approved.

Electric Power in Industry.

Preliminary Report No. 20 upon the 1924 Census of Production, issued with the *Board of Trade Journal* for July 28th, shows that in the fellmongery trade (hides and skins) there was 442 kW of generating plant, and 1,630 h.p. of electric motors (power for 870 h.p. purchased). The leather trades reported 9,315 kW of generating plant (against 1,568 kW in 1907). The motors had an aggregate capacity of 45,677 h.p.; power for 33,536 h.p. was purchased. In the tool and implement trades there was 2,693 kW of generating plant (against 534 in 1927) and 42,834 h.p. of electric motors (power for 39,016 h.p. purchased). The figures for the cutlery trade were:—Generating plant, 412 kW (1924), 578 kW (1907); electric motors, 8,992 h.p. (power purchased for 8,412 h.p.).

Norwegian Trade and Industry.

A report on the industrial and economic conditions in Norway during 1925 and 1926 has been furnished to the Department of Overseas Trade by Mr. C. L. Paus, C.B.E., Commercial Secretary at Oslo (Stationery Office, 2s. net). The engineering industries are said to be in a bad state owing to absence of demand, keen competition between home and foreign firms, high wages, unsettled labour conditions, and the rise of the exchange. Very few concerns have paid dividends, and many have been compelled to write down their capital. Manufacturers of large electrical machinery have had little to do, owing to lack of enterprise in the harnessing of water power, but the considerable number of factories making domestic heating and cooking apparatus have been fairly well occupied. An appendix to the report gives the total imports of machinery during 1926 as 33,137,491 kr., as compared with 44,545,300 kr. in 1925. The export list shows a decline in all electrical sections: Electric motors from 3,215 to 286 kg.; generators and dynamos from 1,281 to 20 kg.; and telephone and telegraph apparatus from 17,620 to 16,656 kg.

Bath Contractors and a Housing Scheme.

The secretary of the Bath branch of the Electrical Contractors' Association has written to the Corporation Housing Committee suggesting that local electrical contractors should have an opportunity of tendering for the electrical work in connection with the Corporation's housing schemes. The Town Clerk has replied that the existing electrical contract was placed by the building contractors.

Unemployment.

The number of registered unemployed increased by 11,480 during the week ended July 18th. On that date the total was 1,048,000, as compared with 1,036,520 on July 11th, and 1,631,268 on July 19th, 1926 (coal stoppage period).

Australian Demand for Increased Duties on Batteries.

Further evidence in support of an application for higher duties on imported storage batteries was heard in Melbourne recently by the Commonwealth Tariff Board. Mr. C. H. Harden, managing director of the United States Light and Heat Corporation (Australia), Ltd., asked that the duty should be 9d. per lb. under the British preferential tariff, and 11d. under the general tariff, or, if higher, 60 per cent. and 72½ per cent. *ad valorem*, respectively. The application was principally in respect of automobile batteries, but it also applied to house-lighting sets. The application was opposed by the secretary of the Federal Council of the Chamber of Automobile industries, who said that in some cases the higher duty would raise the cost of batteries by nearly 50 per cent.

New Italian Companies.

Among the companies recently formed in connection with electricity supply in Italy are the Società Impianti Idroelettrico di Confienza, Milan, with a capital of 500,000 lire; and the Società Idroelettrica Cismon, Rome, capital 100,000 lire.

Annual Holidays.

The works and offices of BROOK MOTORS, LTD., will be closed for the annual holidays from this evening (August 5th) until Monday morning, August 15th.

The works and offices of Messrs. ALLEN, WEST & CO., LTD., Brighton, will reopen on the morning of August 8th after the summer holidays.

Social Events.

The staff of Siemens Lamp Works, Preston, held its second golf competition on July 23rd. An 18-hole stroke competition was played over the Ashton Park course for the "S. H. Callow" prize. After a keen contest, Mr. P. D. Oakley returned the winning card with a net score of 69, Mr. J. N. Aldington being second.

Book Notices.

"The Marketing Problem: How it is being Tackled in U.S.A.," by E. T. Elbourne, A.M.I.Mech.E. With a foreword by Sir Josiah Stamp, G.B.E. (Pp. 216.) London: Longmans, Green & Co., Ltd. Price, 10s.—This book deals in a very comprehensive way with American methods of studying and serving the markets for their products, and consists to a large extent of the views of American commercial leaders upon the various phases of the subject. As the work is expository only and no attempt is made to apply American principles to British practice, it will not arouse hostile criticism, and it is sufficient to indicate some of the matters with which it deals. They include commercial research, official information service, the elimination of waste, trade association activities, auxiliary marketing services, budgetary control, the marketing counsel, publication surveys, advertising, distribution, &c. Over 20 pages are devoted to a list of American business books: the space devoted to what is admittedly an arbitrary list seems excessive. The index of references to individuals and organisations also appears to be unnecessary.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, July, 1927. New York: The Institute. Price, $1.

"The Employees' Guide" to the Ninth Edition of the I.E.E. Regulations for the Electrical Equipment of Buildings. Compiled and published by the Association of Supervising Electrical Engineers. Pp. 71; 7 figs. London: The Association, 43, Russell Square, W.C.1. Price (paper) 10½d., (cloth) 1s. 8d., post free.

"Easy Lessons in Wireless," by R. W. Hutchinson. Pp. viii+168; figs. 141. London: W. B. Clive, University Tutorial Press, Ltd. Price 1s. 6d.

"Science Abstracts," A & B, Vol. XXX, Part 7. July 25th, 1927. London: E. & F. N. Spon, Ltd. Price, 3s. each.

Trade Announcements.

Mr. A. TAYLOR is opening a shop at 6, Dewar Place, Edinburgh, as an electrician, and asks for price lists, catalogues, and showcards of all electrical material.

The MULLARD WIRELESS SERVICE CO., LTD., has removed its head office to Nightingale Works, Nightingale Lane, Balham, S.W.12. The London office—Mullard House, Denmark Street, London, W.C.2—will operate as usual, and all orders for the London area will be executed therefrom.

MESSRS. F. WINKWORTH & CO. are removing their offices to their new works at Ascot, Berks. Telephone: Winkfield Row 127 (3 lines). After August 6th all communications should be addressed to them at Carden Works, Ascot, Berks.

New Catalogues and Lists.

MESSRS. D. H. BONNELLA & SON, LTD., 46-48, Osnaburgh Street, Euston Road, N.W.1.—A fully illustrated and priced catalogue of electric bell accessories of all kinds. One page deals with medical coils.

MESSRS. ISENTHAL & CO., LTD., Victoria Road, Acton, W.3.—An illustrated pamphlet containing a full description of the "N.C." automatic rapid-action voltage regulator.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—List P212, dealing with armoured cables and accessories—joint boxes, pillars, fuses, &c.; and List P217, advertising "Prescot" aluminium matting sections and sheets, and copper sheets.

The IMPERIAL ENGINEERING Co., Lever Street, Wolverhampton.—A priced and illustrated catalogue of the company's domestic electrical appliances.

MR. J. H. HEATHMAN, Parson's Green, Fulham, S.W.6.—An illustrated and priced catalogue (4 pp.) of folding tables, forms, &c.

MESSRS. S. G. BROWN, LTD., North Acton.—The "Brown Budget" for July, containing "sales aids" for dealers in the company's radio apparatus.

MESSRS. J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham.—A blotter drawing attention to the fact that a standard "Tucker" 5-A tumbler switch successfully handled a load of 33 A at 250 V in Faraday House tests.

MESSRS. ROBERT J. ANDERSON, INC., 2416-38, Beekman Street, Cincinnatti, Ohio, U.S.A.—A series of pamphlets advertising the company's metallurgical service.

The ATHOL ENGINEERING Co., Seymour Road, Crumpsall, Manchester.—A price list of coil-holders, valve holders, earthing plugs, and other radio components.

The CHLORIDE ELECTRICAL STORAGE Co., LTD., Clifton Junction, near Manchester.—A poster in striking colours introducing the "Exide" girl (Barribal) and "Exide" batteries. It is produced in two sizes—double-crown and 16-sheet.

MESSRS. SIEMENS BROS. & Co., LTD., Woolwich, S.E.18.—Catalogue 160, Section 1, illustrating and describing "Siemens" feeder pillar; and Leaflet 2,051, dealing with a new automatic alarm device for radio-telegraph sets. Illustrated.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—A folder illustrating examples of the company's motors.

TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., 72, Oxford Street, W.1.—An illustrated price list of gasfilled and vacuum lamps of various types.

MARCONI'S WIRELESS TELEGRAPH Co., LTD., Marconi House, Strand, W.C.2.—Pamphlet No. 240, containing fully-illustrated notes on "Marconi" sets for the reception of time signals and Press bulletins. The publication bears the nominal price of 5s.

Mr. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—An illustrated pamphlet containing a description of the "Inventum" "Night-Tariff" cisterns with electromagnetic control. Priced.

ELECTRIC FIRES, LTD., Heatrae Works, Norwich.—Two illustrated folders—one containing prices and particulars of "Heatrae" cookers and hotplates; the other advertising the company's immersion heaters and illustrating their applications.

Bankruptcy Proceedings.

H. B. POWELL, 10, Union Street, Hereford, wireless dealer.—The public examination of this debtor was held recently at Hereford. The statement of affairs showed liabilities of £864, against assets of £244, leaving a deficiency of £620. Debtor attributed his failure to depreciation of wireless sets owing to new inventions. He had carried on business since November, 1924, borrowing £200 on notes of hand. He had only kept a ledger for goods sold. He had not realised his position until recently. He admitted that he had obtained trade goods on credit after he knew he was in difficulties, but he hoped that trade would improve. The examination was adjourned. The following are creditors:—

	£		£
Brown Bros., Ltd. ...	93	Midland Auto Components	75
Capel's Wholesale Wireless	27	Simpson, Baker & Co....	34
Eagle Engineering Co....	88	South Wales Wireless Installations	20
Greenlands, Ltd. ...	24	Smith, J. E.	200
Houghton-Butcher Co., Ltd.	90	S.D.H. Manufacturing Co.	20
Haslam & Stretton, Ltd.	33		

G. C. LAZENBY, 29, Old Town Street, Plymouth, wireless engineer.—The public examination of this debtor was held on July 22nd, at the Western Law Courts, Plymouth. The statement of affairs showed liabilities of £1,282, against assets of £259. Debtor stated that he commenced business with £250 worth of stock, and £100 in cash, of which £50 was borrowed. At the start the business was a success, but later it fell away owing to the slump in wireless, and the unsuitability of the broadcasting programmes. He continued, however, in the hope that matters would improve. With regard to a confectionery business opened at the wireless establishment in Old Town Street debtor said that his wife opened this with her own money, paying him £1 per week rent. He alleged that the furniture belonged to his wife. Debtor was questioned as to his purchases of furniture and motor cars, and replied that all the effects belonged to his wife. The examination was adjourned.

W. HANNA, wireless dealer, 13, Carey Street, Burnley.—Receiving order made July 21st, on debtor's own petition.

W. ROSS, wireless engineer, 35, Bridge Street, Haverfordwest.—Receiving order made July 22nd, on debtor's own petition. First meeting August 5th, at the Official Receiver's office, 4, Queen Street, Carmarthen. Public examination, August 15th, at the Shirehall, Haverfordwest.

W. G. BAYMAN, electrical engineer, formerly at 13, Russell Street, Plymouth.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released, July 18th.

N. H. WOOD, electrical engineer, 32, Highbury Avenue, Thornton Heath.—Receiving order made July 23rd, on debtor's own petition.

H. L. SMITH, electrician, 155, Tredegar Road, Bow.—Discharged subject to consenting to judgment for £10 being entered against him by the Official Receiver (£10 paid to the Official Receiver in lieu of entering up judgment).

H. A. SANDERS, electricial contractor, The Black Cat Restaurant, Chawston, Beds.—First and final dividend of 2s. in the £, payable August 12th, at the Trustees' offices, Duke Street,

B. MARKS, electrical engineer, late of 27, Canfield Gardens, Kilburn, N.W.—Receiving order made July 27th, on a creditor's petition. First meeting August 9th. Public examination October 14th, both at Carey Street, W.C.

J. A. H. HALLEDAY, electrical engineer, 38b, Worthington Street, City Road, Bradford.—Receiving order made July 27th, on debtor's own petition.

Company Liquidations.

RADIO ACCESSORIES, LTD.—Winding up voluntarily. Liquidator, Mr. E. Maloney, 11, Ironmonger Lane, E.C.—Meeting of creditors at the liquidator's offices on August 15th. Particulars of claims by September 5th.

FELLOWS MAGNETO Co., LTD.—Winding up voluntarily. Liquidator, Mr. T. S. Jones, Broad Street House, New Broad Street, E.C. Meeting of creditors, August 12th, at Cumberland Avenue, Park Royal, N.W. Particulars of claims to the liquidator by August 31st.

Dissolution of Partnership.

"INDUSTRIES," wireless dealers and factors, 8, Blackfriars Road, S.E.1.—Mr. A. M. Cole and Mr. E. J. G. Hurles have dissolved partnership. Mr. Hurles will attend to debts. Mr. Cole will continue the business.

Private Arrangements.

D. HILLSWORTH, trading as Hillsworth Bros., electrical and wireless engineer, Church Street, Basingstoke.—A meeting of creditors was held on July 22nd, at Basingstoke, when a statement of affairs was presented which disclosed liabilities of £651, of which £551 was due to the trade and £100 to cash creditors. The net assets were £523. The debtor's position was attributed to a fire which occurred on his premises last October, causing a loss of nearly £300, which more than accounted for the deficiency. The debtor had a very good business, and several creditors were of the opinion that it could be carried on successfully. The debtor's solicitor offered 20s. in the £, in four equal instalments payable on October 31st next, and January 31st, May 31st, and September 30th, 1928. The offer was accepted and secured by a deed of composition in favour of Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., with a committee of three of the principal creditors. The following are creditors:—

	£		£
Stearn Electric Co., Ltd.	260	Falk, Stadelmann & Co., Ltd.	36
Simpson Baker & Co. ...	30	Sun Electrical Co., Ltd.	38
Macintosh Cable Co., Ltd.	37	Henley's (W. T.) Telegraph Works Co., Ltd.	25

ERNEST PARCELL, wireless and electrical dealer, Eastcheap, Letchworth.—A circular has been issued by Messrs. Corfield and Cripwell, of Balfour House, Finsbury Pavement, E.C.2, stating that at an informal meeting on July 14th it was decided that the debtor should execute a deed of assignment. A further meeting was held on July 20th and a revised statement showing a deficiency of £241 was submitted. The creditors present were of opinion that if a summary sale took place, the result would be prejudicial, and recommended that debtor should be allowed to continue the business under supervision and that a composition of 10s. in the £ should be paid. Certain creditors would not agree to this, unless the second instalment was effectively covered. The debtor has been allowed a few days to make the necessary arrangements, but failing that, the estate will be realised as early as possible. A committee was appointed comprising Mr. J. C. Eastick, Mr. C. Latham, and the representative of the S.D.H. Manufacturing Co.

ISRAEL SHAPIN, trading as the Penton Engineering Co., 15, Cromer Street, W.C., electrical and wireless dealer.—A meeting of creditors was held on July 25th at the offices of Messrs. H. Rainsbury & Co., 65-66, Basinghall Street, E.C., when a statement of affairs was presented which disclosed liabilities of £7,549 and net assets of £3,997, leaving an estimated deficiency, subject to realisation, of £3,562. Mr. Rainsbury said that the debtor had spent a considerable amount of time and money in creating a goodwill for the Penton Engineering Co., which was of considerable value in the trade and could be used to advantage. The debtor was prepared to give his whole time and attention to the development of the business provided someone would come forward and make an offer to the creditors on his behalf. He commenced business about 17 years ago, and traded under the style of the Penton Engineering Company as a manufacturer of ball bearings. When the

wireless business became popular, the ball bearing manufacturing was gradually dropped. The present position was attributed to the considerable amount of time and money spent on experimenting and inventing which, owing to the general trade depression, had not had an opportunity of being exploited. Large sums of money had been spent on advertising. The debtor had also sustained heavy loss through having laid down a special plant which cost between £1,000 and £1,200. The debtor also financed a company to the extent of over £2,500; it did a considerable amount of experimenting, but eventually closed down. Mr. Rainsbury said that he was of opinion that it was not a case for bankruptcy, and he proposed on behalf of a creditor that the deed of assignment already executed should be registered at once. The creditors would not agree to that suggestion, and although no definite resolutions were passed most of the creditors present suggested that the debtor should be requested to file his own petition in bankruptcy. The following are creditors:—

	£		£
Shapin, E. (Mrs.) ...	1,940	De la Rue	104
Ariadne, —	1,244	Weeks & Wilson ...	89
Kayley, E. V.	743	Greiller & Sons ...	54
National Publicity Co.	501	Thornton & Co. ...	52
Maul, F. W., & Co. ...	332	Austin & Co.	46
Burrard, Col.	290	Waterlow & Son ...	41
Lowden, P. W.... ...	200	Graham Amplion, Ltd.	38
Clarke, C. H.	187	Cooper, John	36
Cassirer & Co.	187	Aston & Mander ...	34
Martin Blair	119	Murphy, T. C.	27
Ramie Union	104	Trelleborg, —	25
Hughes, H.	100	East London Rubber Co.	21
Rainsbury, H., & Co....	105		
Moss, B., & Co. ...	96	Anthony Horle ...	21
Ellis & Mort	95	Santo, G.m.b.H. ...	30
Roederschein, Ernest ...	93	Jury Electric Co. ...	24

Local Exhibition.

YORK.—On July 27th the Lord Mayor of York opened an all-electric house adjacent to the Corporation's Tang Hall Estate. The house was lent for the purpose by a member of the Council, and equipped by the Electricity Committee.

Public Works in Ecuador.

The Ecuadorean Government invites tenders for the supply of materials for several public works schemes to be commenced in the capital (Quito). These include water, sewer and distribution systems and an electrical plant. The main work will be carried out by Government engineers, under the supervision of the Minister of Public Works. Keen competition for the contracts for these supplies is expected between German, Italian, and American firms; but it is thought that British firms would have a good chance if efforts were made to secure the contract, and suitable prices submitted. Proposals and catalogues (both to be in Spanish) should be addressed to the Ministerio de Obras Públicas, Quito, Ecuador.—*Reuter's Trade Service* (Quito).

The Newfoundland Electrical Market.

In a recent report on Newfoundland, *Commerce Reports* stated that by reason of the abundant supply of water power, electricity for heating and lighting is becoming more and more popular, and purchases of lamps and electrical appliances show a considerable increase from year to year. Hydro-electric generators are imported usually from Germany because of relatively lower prices, but electrical appliances for houses and shops are obtained chiefly from Canada and the United States.

The Leipzig Fair.

We have received from the London office of the Leipzig Fair, 1, Gower Street, W.C.1, an attractive prospectus of the autumn Fair which extends over the period from August 28th to September 3rd. It contains broad particulars of the exhibits and maps of the city and fair centres.

Recent Contracts.

INDUSTRIAL COMBUSTION ENGINEERS, LTD., have received an order from the Stirling Boiler Co., Ltd., for eight Bailey steam and air flow meters fitted with flue-gas temperature recorders, for the new Hawkesbury power station of the Coventry Corporation.

British Trade with Russia.

In a reply to a question addressed to him recently, Sir P. Cunliffe-Lister, President of the Board of Trade, stated that during June Russian goods to the value of £862,604 were imported into this country, while British products to the value of £274,504 were shipped to Russia.

For Sale.

Wolverhampton Corporation Electricity Department has for disposal a quantity of current limiters. Londonderry County Borough Electricity Department invites offers for surplus generating plant. (See our advertisement pages to-day.)

Price Reductions.

We have received from the Marconiphone Co., Ltd. and Reduced, a list showing the old prices of its valves (23 types) and the new prices which were to come into force on Wednesday last. The reductions, which apply also to the products of other members of the British Valve Makers' Association, are considerable, amounting in some cases to as much as 32 per cent.

The Chloride Electrical Storage Co., Ltd., announces that as from August 1st, very large reductions have been made in the prices of h.t. and grid bias radio batteries.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, August 3rd:—No change in copper prices.

Messrs. James & Shakespeare report, August 3rd:—English pig lead, £25 10s,, 5s. inc.

Messrs. Edward Till & Co. report, August 3rd:—India-rubber Para fine 1s. 4d., 1d. inc.

Lighting and Power Notes.

Adwick-le-Street.—LOAN APPLICATION.—The Urban Council is to apply for permission to borrow £12,805 for its electricity scheme.

Argentine Republic.—BUENOS AIRES.—The total electricity supplied during 1926 by the Compania Hispano-Americana de Electricidad amounted to 450,735,961 kWh, against 421,303,803 kWh for 1925. The power stations of the company now have a total capacity of 227,620 kW, two new 25,000-h.p. steam turbines and generators having been completed during the year at the Central Dock Sud station, where also two 25,000-h.p. sets were put to work in January and April last, respectively. During the year the length of the company's distributing mains was extended from 4,354 to 4,662 miles. Pending the completion of the new super power station in Buenos Aires, which will not be ready until 1929, two further 42,500-h.p. sets have been ordered for the Dock Sud plant, which are to be ready for work next year, and which will be eventually transferred to the super station.

Belfast.—YEAR'S WORKING.—The accounts of the electricity undertaking (late city electrical engineer and manager: Mr. Johnstone Wright) for the year ended March 31st last, show a total income of £379,683, as compared with £355,753 for the previous year. The total costs were £183,079, against £144,467, and the gross profit £196,604 (£211,286). The reduction of capital charges, &c., leaves a net profit of £46,421, against £62,402 for the preceding year. The capital expenditure during the year amounted to £107,713, which included £61,740 for mains. The units generated during the year amounted to 54,458,010, and the maximum load demanded was 24,100 kW.

Brighton.—YEAR'S WORKING.—The statement of accounts of the electricity undertaking (engineer and manager: Mr. John Christie) for the year ended March 31st last, shows a total income of £228,992, as compared with £219,623 for the previous year. The total working expenses amounted to £169,181, against £141,700, leaving a gross balance of £59,811 (£77,923). The deduction of capital charges, &c., leaves a net profit of £1,784, as compared with £25,272 for the previous year. The capital expenditure during the year amounted to £90,044, including £46,822 for machinery and £38,178 for mains, bringing the total outlay for the undertaking up to £1,404,434. The units sold during the year amounted to 23,535,249, against 20,544,390 for the year ended March, 1926. The maximum load on the station was 14,600 kW (12,900 kW). The average price per kWh obtained for all services was 2.12d.

LOAN SANCTIONED.—The Lighting Committee has obtained sanction to borrow £95,500 for generating plant and switchgear.

Chelmsford.—ELECTRICITY UNDERTAKING.—The Electricity Committee recommends the purchasing by the Council of the electricity undertaking from the Electric Supply Corporation if satisfactory terms can be arranged.

Continental.—FRANCE.—During last year the Compagnie Parisienne de Distributions d'Électricité increased its consumers by 66,538, or 13 per cent., bringing the total up to 577,592. The increase in consumption was about 33 million kWh, or 8 per cent., the total for 1926 being 445,000,000. Plans are in progress for increasing the capacity of the power stations at St. Ouen and Issy-les-Moulineaux to 450,000 kW.

Douglas (I.O.M.).—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. Bertram Kelly, on the working of the electricity undertaking for the year ended March 31st, 1927, shows a total income of £25,848, as compared with £19,177 for the previous year. The total working expenses amounted to £13,021, against £8,253, leaving a gross surplus of £12,827 (£10,924). The amount in respect of interest and sinking fund which is charged against the gross profit leaves a net surplus of £2,572. The capital expenditure for the undertaking for the year amounted to £4,880. The total units generated were 1,482,545, and the supply demanded 804 kW.

Glasgow.—DALMARNOCK TURBO SET.—The No. 5 turbo-alternator set at the Dalmarnock station, which was put into commission in January, 1923, has not yet been taken over from the contractors as in a serviceable condition. The contractors claim to have located the trouble in the shaft, and it is recommended that they be allowed to renew the shaft, at their own expense. Further negotiations are to be opened up with regard to the proposal for replacing the turbine and alternator with a new and larger set.

NEW STATION.—The Electricity Commissioners have formally consented to the erection of a generating station at the new refuse disposal works at Govan, and it is recommended that the necessary steps be taken to have the station accepted as a selected station by the Central Electricity Board.

Greenock.—SUPPLY TO COAST.—A previous decision not to proceed with the scheme for supplying electricity to Inverkip and Wemyss Bay was considered at a special meeting of the Corporation on July 26th, when the necessary majority on a division to overturn the previous finding was not obtained.

Guildford.—LOAN SANCTIONED.—The Corporation has received sanction to borrow £2,350 for the provision of reserve pumping plant and electrical controls at the Drummond Road pumping station, and reserve air compressor plant at the destructor works.

Irish Free State.—LIMERICK.—In consequence of the deterioration of the electricity plant in Limerick city and the failure of the Government to sanction expenditure for renovations, an engineer from Dublin is to be sent to Limerick for the purpose of discussing such revisions and improvements as are necessary.

SHANNON SCHEME.—A large number of steel transmission poles have arrived from Germany and are being distributed.

Ilford.—LOAN SANCTIONED.—The Corporation has obtained sanction to borrow £50,000 for mains and services.

Japan.—HOKKAIDO.—The Electric Light Co. is to install a new 3,000-kW turbo-alternator, switchgear and transformers at a cost of about 400,000 yen.

TOHO.—The Toho Denryoku K.K. is to purchase one 5,000-kW synchronous advancer for its Kyushu transmission system.

KIZU-GAWA.—Work on the new generating station of the Ujigawa Electric Co. is progressing satisfactorily, and it is expected that the first of the two 30,000-kW generators will be put in operation in August.

Kingston-on-Thames.—BULK SUPPLY:—The electrical apparatus at the sewerage works is to be converted for the new standard voltage, at a cost of £1,950. With regard to the bulk supply to Walton Urban Council, the Commissioners have intimated that they hope shortly to complete an electricity scheme for London and South-East England for submission to the Central Electricity Board, and in the circumstances they are of opinion that Walton should continue to take its supply for the time being from the present source.

London.—POPLAR.—The Electricity Committee is to provide soot-blowing apparatus at an estimated cost of £1,176.

ISLINGTON.—The Electricity Committee has prepared a scheme for assisted wiring.

ST. PANCRAS.—The Electricity Committee is seeking sanction for a loan of £13,500 for mains in connection with the development of the Holly Lodge estate, Highgate.

Liverpool.—MAINS EXTENSIONS.—The Electricity Committee has granted authority for the extension of h.p. mains from Garston Old Road sub-station and from Rose Lane to the Holmefield Road at an estimated cost of £14,902.

Nottingham.—RATES CONTRIBUTION.—The Corporation has determined to standardise the contributions of the municipal trading departments for the relief of rates, fixing that to be found yearly by the Electricity Department at an amount equal to a rate of 3½d. in the £, on condition that the produce of a penny rate does not exceed £7,000.

Oldham.—YEAR'S WORKING.—The results of the year's working, ended March 25th last, for the electricity undertaking (borough electrical engineer: Mr. F. L. Ogden) show a total income of £298,407, as compared with £247,425 for the previous year, and total working expenses of £214,094, against £148,125, leaving a gross balance of £84,313 (£99,300). After the deduction of capital expenses, &c., a net profit of £14,115 is shown, as compared with £30,416 for the preceding year. The capital expenditure during the year was £75,052, which included £49,880 for mains and £15,405 for the new station at Chadderton. The total units generated during the year amounted to 53,816,800 and the maximum load on the station was 24,600 kW.

Price Reductions.—GLASGOW.—The Electricity Committee has reduced the supply charges to the pre-general-strike rates, *viz.*, private lighting, 6d. per unit; current consumed over the maximum demand quantity, 1½d.

RUGBY.—The Urban Council has adopted a two-tariff scheme for the supply of electricity, under which the price of current for domestic heating and cooking will be reduced from 1½d. to 1d. per unit. These charges apply only to dwelling-houses and to hotels continuously running complete hotel services.

PAISLEY.—The Town Council has reduced the price of electricity by taking off the 10 per cent. added during the coal strike.

AYRSHIRE.—The Electricity Board is reducing its charges all round and adopting a new scale for the supply of electricity for heating water between the hours of 6.30 and 7.30 a.m. The charge will be at the rate of ½d. per kWh, and new meters will be provided for this. No change is made in the charge for public lighting, but the charge for light for other consumers is to be reduced from 6d. to 5½d. per kWh.

SHREWSBURY.—The Town Council has reduced the charges for electricity for lighting from 4½d. to 4d. per kWh; and for power and heating from 3d. to 2d. up to 300 kWh per quarter, and from 2d. to 1½d. for from 300 to 600 units per quarter.

KINGSTON-ON-THAMES.—The Town Council is recommended to reduce the charges for electricity to churches, theatres, kinemas, and for outside lighting of business premises from 6d. to 5½d. per kWh.

WREXHAM.—The Town Council has fixed the following scale of charges for electricity as from October 1st next:—General lighting, flat rate of 6d. per kWh up to 1,000 kWh per quarter, 1,000 to 2,000 kWh 5d., beyond 2½d., less 5 per cent. discount; lighting, heating and other domestic purposes in private dwellings only (alternative rate), 20 per cent. of the rateable value and 1d. per kWh for electricity consumed, less 5 per cent.; shops and other business premises using over 250 kWh each summer quarter and 500 each winter quarter, a fixed rental of 2s. 6d. per summer quarter, and 6s. per winter quarter in respect of each 100-W lamp, or its equivalent, installed, and 2½d. per kWh for all electricity consumed, less 5 per cent.; slot meters, 8d. per kWh; heating and cooking, flat rate of 1½d. per kWh, less 5 per cent.; power, up to 1,000 kWh per quarter, 3d. per kWh up to 500, and 2½d. beyond, less 5 per cent.; over 1,000 kWh per quarter, 3d. per kWh up to 500 units, 2½d. from 500 to 1,000, and 2d. beyond, less 5 per cent. Where 10,000 kWh per quarter are consumed, special rates for lighting and power may be arranged.

LIVERPOOL.—The Corporation has entered into special agreements providing for the adjustment of charges by withdrawing the increased charge of 5 per cent. authorised by the Resolution of the Council of June 3rd, 1925, and by raising the basic price of fuel from 10s. per ton to 13s. per ton, or from 9s. per ton to 12s. per ton, as the case may be. The charge for electrical energy for the Tramways Department has been fixed at 1d. per kWh, plus an addition of .018d. per unit for each shilling by which the cost of fuel exceeds 13s. per ton.

BRIGHTON.—The Lighting Committee has decided to reduce its charges from September as under:—For the first 10,000 kWh or less per annum, from 4½d. to 4d. per kWh; the second 10,000 units, from 4d. to 3½d.; the third 10,000, from 3d. to 2½d. All over 30,000 kWh will remain at 2d. per kWh.

Scunthorpe and Frodingham.—ELECTRICITY SUPPLY.—A comprehensive scheme has been prepared for the supply of electricity to the surrounding districts.

Seaham.—SUPPLY INAUGURATION.—It is expected that sufficient progress will be made by the Urban District Council electricity department for the supply to be switched on on September 2nd next.

Shotts.—COLLIERY ELECTRIFICATION.—With the object of completely electrifying the whole of its Shotts and Baton collieries, the Shotts Iron Co. has just completed a 3,000-V transmission line, between three and four miles long, to carry 2,000 h.p.

Special Orders.—Application has been made to the Electricity Commissioners by Messrs. Old Silkstone Collieries, Ltd., for a Special Order to supply electricity in the urban districts of Arlecdon and Frizington, Aspatria, Cockermouth, Harrington and Maryport, the rural district of Cockermouth, and the parishes or townships of Distington, Moresby, Parton and Whiddicar, in the rural district of Whitehaven, all in the county of Cumberland.

Application has been made to the Electricity Commissioners by the Bridgwater and District Electric Supply and Traction Co., Ltd., for a Special Order to supply electricity in certain parishes in the rural district of Bridgwater.

Warrington.—MAINS EXTENSION.—The Electricity Committee is to lay a cable to supply the Agden Salt Works, Ltd., Lymm, at a cost of £2,349.

West Bromwich.—LOAN APPLICATION.—The Town Council has decided to apply for sanction to borrow £8,000 for mains to supply that portion of Perry Barr to be added to West Bromwich.

Weymouth.—SUPPLY FAILURE.—The electricity supply at Weymouth failed for an hour on July 26th owing to a workman who was driving an iron spike into the ground accidentally piercing a main electric cable.

Wimbledon.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. A. E. McKenzie) on the working of the electricity undertaking for the year ended March 31st last, shows a total income of £144,869, as compared with £130,987 for the previous year. The total working expenses amounted to £83,298, against £55,196, leaving a gross profit of £61,571 (£75,791). The deduction of capital charges, &c.,

leaves a net profit of £19,951, as compared with £33,505 for the year ended March, 1926. The capital expenditure during the year amounted to £70,912, which included £31,767 for mains and £18,491 for machinery. 18,584,910 units were generated during the year, and the maximum load demanded was 7,450 kW. The average price per kWh obtained for all purposes was 2.089d.

Extension Consent.—The Electricity Committee has received consent for the installation of a 3,750-kW, single-phase, 50-cycle turbo-alternator, and a 50,000-lb. boiler.

Street Lighting.—The Electricity Committee reports that the agreement between the Corporation and the Maldens and Coombe Council as to the street lighting of its district has now been completed.

Tramway and Railway Notes.

Australia.—Belgrave.—The electrification of the narrow-gauge railway from Ferntree Gully to Belgrave, and probably further, and its conversion to broad gauge are contemplated by the Railway Commissioners.

Continental.—Austria.—The work of electrifying the Austrian State Railways and of providing further electricity for Vienna, estimated to cost in all over £5,000,000, is to be entrusted to German firms. The Enns water-power works is to be greatly extended, and transmission lines are to be erected in the Burgenland. Negotiations are proceeding with the German and American groups regarding the financing of the development, and it is considered probable that a big loan will be issued on various capital markets.

Spain.—It is reported that the results of the electrification of parts of the North Spanish railways are satisfactory. Twelve 18,960-h.p. electric locomotives have been substituted for 30 steam locomotives.

Turkey.—*Bosphorus Railway.*—A scheme is to be examined under the auspices of the Turkish Ministry of Public Works for the construction either of a suspension bridge over the Bosphorus, or, alternatively, of a "tube tunnel" under it. The latter solution is said to be the more generally favoured, and will probably be adopted. Some Turkish capital is already available for the purpose, but it is expected that the necessary balance will be provided by a group of German banks and industrialists, who would secure the contract for the construction of the tunnel and the electric railway which would run through it.

Poland.—*Warsaw.*—A project of the City Tramway Co. for the construction of a subway system has been considered favourably, and the administration of the city street railroads has now been instructed to fix the lines which are to cross the city from north to south and from east to west.

Dover.—Loan Sanctioned.—The Corporation has received sanction to borrow £957, for the purpose of relaying the tramway track in High Street.

Halifax.—The Corporation Tramway Committee is giving consideration to an allegation by the Calder and Hebble Navigation, Ltd., that a canal bridge at Stainland Road is giving way owing to the weight of Halifax Corporation electric tramcars which cross it. The Corporation denies liability, and has requested the Calder and Hebble Navigation to repair the bridge as soon as possible.

Honley.—During a thunderstorm on July 27th, lightning caused a short circuit in the controller of an electric tramcar and the car was put out of action. There was no personal injury.

Japan.—Osaka.—An underground line and an elevated electric line are likely to be approved shortly for the city, at a cost of 162,000,000 yen.

Lancaster.—Lightning Accident.—During a thunderstorm on July 27th lightning struck a Corporation electric tramcar on Bowerham Hill.

London.—Underground.—A new comb-type escalator is to be put into service at Waterloo soon. This stairway is one of three which will connect the Hampstead and Bakerloo Tubes with the main-line station. A new system of concealed lighting has been introduced in the new escalator tunnel. The lamps are supported on pedestal holders fixed to the handrail balustrade and throw their light on to the roof.

Metropolitan Tramways.—The Metropolitan Electric Tramways Co. is to be urged to expedite the conclusion of negotiations in respect of the renewal of its lease, which terminates on December 31st, 1930, from Middlesex County Council.

United States.—Staten Island.—The New York correspondent of *The Times* reports that the Staten Island Edison Power Company put the municipally-owned tramway system of the island completely out of action on August 1st by cutting off the power. This was a sequel to the failure, after due warning, of the City authorities to pay their debt of $175,000 for power already supplied. The city has retaliated by arranging an adequate omnibus service. A bill was recently presented at a meeting of the City Board of Estimates, but payment was not forthcoming. The precise reasons are unknown. In some quarters it is said that the Controller vetoed payment on the ground that the city was losing money on the existing system, in others merely that an extension of time was desired.

New York.—The Board of Estimates has authorised a sum of $150,000,000 (£30,000,000) for the construction of underground railways and for a new system of omnibuses throughout the city. It is expected that the underground railways, which will be confined to the Brooklyn section of the Metropolis, will be completed in about four years.

Telegraph and Telephone Notes.

Cable Telegraphy.—Rate Reduction.—Following on recent reductions in rates to Australia and New Zealand, and a request from the Postmaster-General of the Union of South Africa for corresponding reductions in South African rates, the Eastern Telegraph Co., Ltd., decided to reduce the telegraph rates between Britain and the Union of South Africa, from August 1st. Corresponding reductions will also be made for telegrams exchanged with South-West Africa, Southern and Northern Rhodesia, and Nyasaland.

An all-round reduction in rates for telegrams to South America was announced on July 25th by the Commercial Cable Co. and also by the Eastern Telegraph Co., *via* Eastern Madeira, and the Western Union Co.

The Telegraph Service.—Committee of Inquiry.—On July 29th the Postmaster-General announced in the House of Commons that he was about to appoint a Committee to examine the possibility of effecting substantial economies in the working of the inland telegraph service. The Committee, accepting the scales of pay awarded by the Industrial Court, would report on what changes were necessary to extinguish, or substantially reduce, the continuing deficit on the service. The Committee would start work in the autumn and would consist of Sir Hardman Lever (chairman), Lord Ashfield, and Sir Harry McGowan. In the last four years the average loss has been £1,478,125; last year it was £1,299,214.

Radio Notes.

Austria.—Developments.—At the last meeting of the Board of the Ravag, Dr. Schwaiger submitted a bold plan for the development of Vienna broadcasting and for building a relay station at Linz. According to *World Radio* Rosenhuegel is to be provided with new transmitting plant and its power raised to 60 kW this summer, when the engine, accumulator, and power rooms will be considerably enlarged. A studio, 90 ft. by 39 ft., will be built, in addition to two studios of the size of the present one and a third of smaller dimensions for talks, as well as rooms for testing and technical equipment. This work will involve an outlay of 12 million schilling.

France.—New Station.—The wireless-telephone station at Lille, which is to serve Northern France, has been formally inaugurated by a representative of the Ministry of Posts and Telegraphs in the presence of the local authorities. Hitherto, although Southern France has been well provided with wireless centres at Bordeaux, Toulouse, Marseilles, Lyons, &c., the north has not.—*Reuter* (Paris).

Germany.—Receivers on Approval.—In order to further business, the Munich Postal Administration is to allow responsible firms to erect receiving sets for prospective customers during a week as a test without the licence fee being paid, in order to allow purchasers sufficient time to satisfy themselves about the set they desire to purchase.

Irish Free State.—Experimental Licences.—In Dail Eireann the Minister of Posts and Telegraphs was asked what special privileges, or rights, attached to an experimental licence, as compared with the ordinary receiving licence, and whether he was prepared to consider the reduction of the fee charged for an experimental licence from £1 to the rate charged for an ordinary licence. Mr. J. J. Walsh said that, from the technical point of view, the maintenance of a distinction between experimental and ordinary receiving stations was no longer a matter of much importance, and the question of regarding the ordinary licence, the fee for which was 10s. a year, as covering the use of any form of receiving set was under consideration.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—August 8th. Urban District Council. Cast-iron lamp columns, lanterns, time switches, cables, joint boxes, &c. (July 22nd.)

Argentina.—BUENOS AIRES.—October 5th. National Sanitation Works. Pumping machinery and electric generating plant. (A.X. 4996.)*

Australia.—MELBOURNE.—November 14th. State Electricity Commission of Victoria. Two 10,000-kW back-pressure turbo-generators and accessory plant. (July 1st.) One 40-ton single-crab, 3-motor type electrically-operating travelling crane. (July 15th.)

Eight tubular steam coal driers; seven electrically-operated briquette presses; central waste coal dust collecting system. (A.X. 4011.)*

October 24th. Armour-clad switchgear and accessories. (B.X. 3681.)*

November 21st. Five centrifugal feed pumps.

November 28th. Four h.p. water-tube boilers and accessory plant and steel work for buildings.

September 13th. Postmaster-General's Department. Automatic switching equipment. (B.X. 3658.)*

September 20th. Telephone switchboard keys and parts. (B.X. 3657.)*

September 20th. Indicators for telephone exchanges. (B.X. 3660.)*

MELBOURNE.—October 11th. Harbour Trust Commissioners. Two 3-ton and two 5-ton semi-portal electric cargo cranes. (A.X. 4992.)*

Belfast.—August 10th. Education Committee. Electric motors, dynamometers, &c., for the Electrical Engineering Department, Municipal College of Technology. (July 22nd.)

Electricity Committee. 3-phase e.h.p. a.c. switchgear. (See this issue.)

Dublin.—Dublin United Tramways Co. (1896), Ltd. Eleven miles of 3-core lead-covered e.h.p. cable. (July 29th.)

Edinburgh.—August 22nd. Electricity Supply Department. H.p. and l.p. steam and water pipes, circulating-water pipes, flue dust extraction plant, h.p. steam and water valves, and l.p. water valves. (July 15th.)

Grays.—August 10th. Orsett Rural District Council. Automatic electrical pumping station at Aveley. Mr. G. F. Andrassy, engineer, Council Offices, Palmers Avenue, Grays, Essex.

India.—August 9th. India Stores Department. 6½ miles 40 conductor armoured cable. (July 29th.)

Leeds. — September 17th. Electricity Department. Boiler-house equipment, including conveying plant, wharf cranes, &c., for the first section of a new generating station. (July 22nd.)

London.—H.M. Office of Works. August 15th. Steel conduits and fittings for electric wiring. (See this issue.)

Manchester.—August 19th. Twelve months' supply of electric cooking ranges, switches, and cut-outs. (July 29th.)

Newton-in-Makerfield.—August 22nd. Electricity Committee. 3,800 yd. l.p. paper-insulated lead-covered armoured cable. (See this issue.)

New Zealand.—WELLINGTON.—September 13th. Public Works Department. Two sets 110-kV outdoor switchgear for the Waikato electric power scheme. (B.X. 3579.)*

October 4th. Batteries and charging sets for Mangahao electric power scheme. (B.X. 3580.)* 50-kV lightning arrestors for Waikaremoana. (B.X. 3603.)* 11,000-V switchgear and metering equipment. (B.X. 3602.)* 50-kV lightning arrestors for Waikato. (B.X. 3605.)*

September 27th. One 15-ton electrically-operated overhead travelling crane. (A.X. 4849.)*

October 25th. 10,000-kVA transformers for Waikato. (B.X. 3604.)*

November 24th. New Zealand Government Railways. Heating elements, complete with control gear, for electric ovens, electric water heaters, electric steam boiler. (B.X. 3649.)*

Plymouth.—August 22nd. Electricity Department. Transporter beam for coal conveyor. (See this issue.)

South Africa.—JOHANNESBURG.—August 29th. Municipal Council. One 75-kW rotary convertor and transformer. (B.X. 3661.)*

September 8th. Railways and Harbours. Three 4-ton electrically-driven portal jib cranes. (A.X. 4991.)*

Wick.—August 22nd. Town Council. Distribution mains, services, &c., generating machinery, equipment, &c., station building, &c.; hydro-electric plant, &c. Schedules from Mr. J. E. MacEwan, 108, Douglas Street, Glasgow.

Worksop.—August 8th. Installation work in connection with the Council's hired wiring scheme. Specifications from Engineer and Manager, Electricity Works, Canal Road.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—BRISBANE.—City Council. Accepted:—
70,273 yd. underground cable (double armoured) (£64,382). Siemens (Aust.) Pty., Ltd.
2 miles insulated copper cable (£686).—W. Adams & Co., Ltd.

MELBOURNE.—Electricity Supply Committee. Accepted:—
23,675 yd. single conductor lead-covered cable (£13,092).—Metropolitan-Vickers Electrical Co., Ltd.
6,580 yd. 3-core lead-covered cable (£3,438).—Siemens (Aust.) Pty., Ltd.
Three 500-kVA. 3-phase transformers (£1,194).—Weymouths, Ltd.

SYDNEY.—Electricity Supply Committee. Accepted:—
Supply of station auxiliary power switchgear (Spec. 1,092) (£78,261).—Australian General Electric Co., Ltd.
Fibre conduits (£1,428) (Spec. 1,126).—Standard Telephones and Cables (Aust.), Ltd.

—*Tenders.*

Barking Town.—Housing Committee. Recommended:—
Wiring 18 flats for electricity at Eastbury estate (£123).—F. W. Jameson.

Bexhill.—Electricity Committee. Recommended:—
Cable.—Enfield Cable Works, Ltd. (£184).

Durham.—County Education Committee. Accepted:—
Electric lighting at Leadgate Council School (£194).—Devereux, Moodie & Co. (Newcastle).

Glasgow.—Electricity Committee. Recommended:—
Rubbish culvert in connection with the screening plant at the Dalmarnock power station (£625).—Sir Wm. Arrol & Co., Ltd.

Tramways Committee. Accepted:—
Platform-type resistances.—Electro-Mechanical Brake Co., Ltd., and Traction Equipment Co., Ltd.
D.c.c. wire.—British Insulated Cables, Ltd.
Insulated bolts.—British Insulated Cables, Ltd., and Birkbys, Ltd.
Steel tires.—Steel Co. of Scotland, Ltd., and W. Beardmore & Co., Ltd.

Hull.—Electricity Committee. Accepted:—
Steel coal bunker £8,000).—Heenan & Froude, Ltd.
Overhead street lighting in Osborne Street and Waterhouse Lane (£513).—City Electrical Co.

Ilford.—Electricity Committee. Recommended:—
E.h.t. switchgear (£334).—General Electric Supply Co., Ltd.
Two miles of cable.—Metropolitan Cable & Construction Co., Ltd., in lieu of Greenwich Cable Works, Ltd.

Lamp Contracts.—Edison Swan Electric Co., Ltd., has received contracts for the supply of electric lamps from the Admiralty and the Nottingham Corporation Electricity Department.

Leeds.—Electricity Committee. Accepted:—
Cable.—(£2,635) Macintosh Cable Co., Ltd.; (£1,305) W. T. Henley's Telegraph Works Co., Ltd.; (£1,960) Enfield Cable Works, Ltd.; and (£1,431) Greenwich Cable Works, Ltd.

Liverpool.—The Electric Power and Lighting Committee.

The following tenders for switchgear for electric static substations have been accepted:—High-tension switchgear: Type A. Feeder cubicles, at £130 15s. per cubicle; Type B. Feeder cubicles, at £119 5s. per cubicle; Type C. Transformer

cubicles, at £101 per cubicle; Type A. Interconnector cubicles, at £74 5s. per cubicle; Type E. Meter cubicles, at £126 15s. per cubicle.—Ferguson, Pailin, Ltd. Low-tension switchgear: Type A. Transformer and distributor panel, £227; Type B. Transformer and distributor panel, £227; Type C. Transformer and distributor panel, £213; Type D. Two transformers and two distributors, £440; Type E. Three transformers and two distributors, £572.—Metropolitan-Vickers Electrical Co., Ltd.

Switchgear in connection with the Aintree sub-station.—6,000-volt panels (£3,890).—A. Reyrolle & Co., Ltd.

6,000-V switchgear at Lister Drive station (£4,195).—Metropolitan-Vickers Electrical Co., Ltd.

London.—WANDSWORTH.—General Purposes Committee. Accepted:—

Electric lighting installation at Town Hall (£1,066).—County of London Electric Supply Co., Ltd.

Baths Committee. Accepted:—

Electric lighting installation, new baths at Streatham (£834).—County of London Electric Supply Co., Ltd.

ADMIRALTY.—Director of Navy Contracts. Accepted:—

"Cosmos" vacuum ordinary traction, and gasfilled lamps.—Metro-Vick Supplies, Ltd.

METROPOLITAN ASYLUMS BOARD.—Accepted:—

One horizontal tube, "Zeta" type, water-tube boiler, with chain grate stoker, feed pumps, &c., for the Darenth Training Colony.—John Thompson Water Tube Boilers, Ltd.

ST. PANCRAS.—Electricity Committee. Recommended:—

Installation of dust collecting apparatus to boilers at King's Cross station (£1,645).—Pneumatic Conveyance and Extraction Co., Ltd.

ISLINGTON.—Electricity Committee. Recommended:—

Three rotary power factor correctors (£9,947).—English Electric Co., Ltd.

Laying main for supply to L.N.E.R. (approximately) £750.—British Insulated Cables, Ltd.

STEPNEY.—Electricity Committee. Recommended:—

Three water-tube boilers with chimneys, economisers, &c. (£89,398).—Spearing & Co.

One 20,000-kW turbo-alternator with condenser, accessories and switchgear (£57,226).—Escher, Wyss & Co.

SOUTHWARK.—Electricity Committee. Accepted:—

Repairs to cooling tower (£245).—Davenport Engineering Co., Ltd.

Rugby.—Urban Council. Accepted:—

2,000 yd. of cable (£314).—W. T. Henley's Telegraph Works Co., Ltd.

Seaham Harbour.—Electricity Committee. Accepted:—

High-pressure switchgear (£728).—Gray Bros. (Newcastle), Ltd. (In lieu of withdrawn tender.)

Housing Committee. Accepted:—

Wiring 72 cottages on Carr Housing Estate (£26 13s. 6d. per block of eight).—Harrison Bros.

Smethwick.—Accepted:—

Electric lighting installation at the Smethwick Free Library.—Walker & Co.

Southend-on-Sea.—Town Council. At the meeting of the Council last week the chairman of the Electricity Committee reported that 18 tenders had been received for the supply of cable for mains and services, and although all the specifications were the same, on a tender of £15,890 there was a difference of £4,836 between the lowest British firm and the tender of a French firm, nearly 25 per cent. The British prices ranged from £18,000 to £15,890, while the Continental quotations fell as low as £11,054, others being £11,460, £12,143, &c. Councillor Weber said the lowest tender came from France, one of our Allies. The point they had to consider was that the English firm who had supplied the Corporation with cable for years had refused to tender. The Town Clerk had written to them, but he had received no reply. He understood Southend had been allocated by the cable combine to another company. The Committee had come to the decision to seek the views of the Council as to whether they should consider the foreign tenders. After some discussion the Council agreed that the Committee be allowed to review the whole of the tenders, irrespective of country of origin. In reply to Councillor Tattersall, the Mayor said the standing order excluding consideration of ex-enemy countries' tenders was still in force.

3,000 meter boards.—T. De Halle (Grimsby). Accepted:

Stoke-on-Trent.—Electricity Committee. Accepted:—

Distributor wiring, Acres Wood housing site (£280).—Barnett & Soans.

Extensions lighting and motor circuits at central power house (£816).—Hawley & Ingram.

Two electrically-driven vertical centrifugal pumps (£140).—Holden & Brooke, Ltd.

Aerial distributors and services for 400 houses on Abbey Hulton estate.—Barnett & Soans.

Hospital Committee. Accepted:—

Electric wiring, switchboard and motors for infectious diseases hospital (£1,193).—Eastern Counties Electric Construction Co., Ltd.

Tynemouth.—According to the *Yorkshire Press*, the Town Council last week placed two small orders abroad for electrical equipment as a protest against the reported combine among English manufacturers. It was stated that on an expenditure of just under £800 the Council was saving £275. Only one member of the Council questioned the wisdom of the decision.

Wimbledon.—Electricity Committee. Recommended:—

Water-tube boiler, with superheater, economiser, coal elevators and bunkers, &c. (£27,024).—Babcock and Wilcox, Ltd.

York.—The City Council last week approved the recommendation of the Electricity Committee to accept a French tender for the supply of 3,000 yards of cable at £1,176. It was stated that this was 15.4 per cent. less than the lowest English tender.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

ARDWINOT insulation.

Papier maché reflectors, exactly similar to the common metal blue enamelled shades used in factory lighting.

We also desire to learn the names of any firms who recap lamps completely.

We also have an inquiry for the present address of Messrs. E. & C. GATES, Norwich, or successors.

R. A. SMITH, pattern connectors.

Notes.

The Faraday Memorial.

The Southwark Borough Council Electricity Committee reports that the Council of the Institution of Electrical Engineers has decided to present a replica of the Faraday bust in the possession of the Institution, together with a set of the back numbers of the I.E.E. *Journal*. Professor Elihu Thomson (who recently came from the United States to receive the Faraday Medal awarded by the Institution) has expressed cordial appreciation of the Council's scheme and has promised to become a foundation donor of the Faraday Memorial; he has promised to use his influence in America and other countries to forward the Council's purpose. Friday, October 28th next, has been fixed for the inauguration of the memorial by Sir Oliver Lodge, who expressed willingness to co-operate in the following cordial terms:—"A scheme to make the genius of Faraday more appreciated by this and succeeding generations appeals to me strongly, and I am glad to realise that you have already secured such very appropriate and powerful initial support."

Appointments Vacant.

Clerk of works (electrical) for St. Stephen's Hospital. Draughtsman for the London and Home Counties Joint Electricity Authority. (See our advertisement pages to-day.)

Fuel Conference, 1928.

With reference to the Fuel Conference which is to be held next year under the auspices of the World Power Conference (*vide* our last issue, p. 192), it is reported that Sir John Snell, Mr. R. P. Sloan, and Mr. C. H. Merz are to be members of the British National Committee.

Rubber-Armoured Flexible.

With a view to overcoming the difficulty often met with on ordinary flexible cords, that of breakage at the point of contact with the connectors, Messrs. Armorduct Cable Co. have produced a special non-kinking, damp-proof flex, "Armorduct Guttaflex." It is armoured with a close mesh of rubbered cotton strands, affording, it is claimed, perfect protection from breakage and safety from shock. This interlaced braiding is designed to allow just the right degree of flexibility to prevent kinking, while permitting absolute freedom in the use of the apparatus which it feeds. The conductors are of tinned copper and are covered first with double vulcanised insulation, and then with ordinary rubber. The rubber cords are coloured red and blue. The cable is stocked in 36-yard coils in five sizes, ranging from 23/36 to 110/36, twin.

Educational.

GERMANY.—With the support of the Prussian Ministry of Science, Arts, and Public Education, a Chair of Electrical Economy has just been established at the Technical High School of Berlin. Dr. Jur Walther Windel, chief engineer of the Siemens-Schuckertwerke Gesellschaft of Berlin, who has been elected to the chair, will deliver a series of lectures this summer on the economical uses of electricity.

A Period-Charging Scheme.

We have received from Capt. C. J. Turner, A.M.I.E.E., of the Hoylake, Cheshire, power station, an interesting suggestion for a method of period-charging for heating or cooking loads, alternative rates being governed by the lighting load. The scheme provides for a solenoid device in the lighting circuit, which controls the shunt circuits of the power meters. Either two main meters in series or one main and one sub-meter can be used for the power consumption recording. With the two main meters the solenoid apparatus puts one shunt in circuit when the lighting load reaches a predetermined figure, say, 100 W, and the other meter shunt when the lighting load is below that figure. Where one of the power meters is a "sub" the shunt of this only is controlled by the solenoid so that the meter records when the lighting load is below the given amount. The registered consumption on this meter can therefore be deducted from that of the main meter and charged at the lower rate.

A New "Push-Button" Device.

A new type of electric cord which acts as a push-button at any point of its length is coming into use in Berlin in connection with electric bells and buzzers and for starting and stopping machinery. It is the invention of Mr. Oscar Nagy, a Hungarian engineer, says *Nature*, which explains that if the cable is squeezed at any point throughout its length, the circuit is completed and the signalling or operating device is actuated. This is effected by having the wires woven into a loose braid separated by an elastic non-conductor, which, however, makes contact when pressure is applied. It is expected that this device can be usefully employed with complicated machinery where threatened accidents to either operator or material make sudden stopping a necessity. It can be operated also by the knee or the elbow, and so has advantages over ordinary types of switches and push buttons. Hidden beneath carpets it would make a useful burglar alarm. In mines and quarries it could be arranged so that a fall or slide of rock would automatically sound an emergency signal.

Frequency Change-over.

At a meeting of the Council of the Birmingham Chamber of Commerce recently, Mr. R. C. Rodgers presented a report of the Executive Committee of the Manufacturers' Section on the Electricity Supply Act, 1926, stating that a letter and *questionnaire* had been prepared for issue to consumers of h.p. current in Birmingham, requesting their opinion on the proposed change of frequency from 25 to 50 cycles, and an approximate estimate of the cost to them, if such a scheme were introduced by the Central Electricity Board. He pointed out that, apart from the cost of the change-over there would be serious disturbance at a large number of works and loss of working time. He urged that no order should be made in Birmingham until the fullest inquiry had been made in collaboration with the Electric Supply Committee. In the event of a change-over being made compulsory, the Committee considered that the only way it could satisfactorily be done was by providing new motors. Mr. T. Parker Smith urged that the bogey of disturbance and loss was not quite such a serious business as had been represented. The change-over was a serious matter for the city to face, but the benefit of being connected up with the whole of the country in reducing the cost of electricity per unit might be greater than they realised.—Mr. T. Sidney Walker suggested that Birmingham should wait three or four years to see what the cost was to Glasgow, which had consented to be scheduled.—Mr. Rodgers replied that the Committee was not criticising the ultimate benefit of the scheme, but the immediate expenditure, and the opportune time for putting the district to such expenditure. The report was adopted.

Distant Control.

An interesting synchronised stone-laying ceremony recently took place in London in connection with the Masonic Peace Memorial. At the Royal Albert Hall there was set up on the stage an electrically-operated model of a crane, which was operated by push buttons close by, and raised and lowered a model of the foundation stone in the manner required by the Craft in this ceremony. The operations at the Albert Hall were duplicated on the site of the new building, and the actual foundation stone was laid in position simultaneously with the symbolic model three miles away. The work was carried out by Etchells, Congdon & Muir, Ltd., lift makers, of Manchester, who had the co-operation of Post Office engineers, who provided the land lines between the two points. The weight of the actual stone on the site of the new building was two tons, and this example of the distant control of power with such minuteness is very interesting to all engineers.

Mountain Climber Killed by Lightning.

According to a correspondent of the *Morning Post*, a party led by Father Lauto, of the Cappuccini Convent, Roveredo, accomplished the difficult ascent of the Marmolada (11,020 feet), the highest summit of the Dolomites, but during the descent it was caught on an exposed ledge by a severe thunderstorm. Suddenly the wire rope round the waist of the leader was struck, and Father Lauto was burned to ashes in a blinding flash. His companions were thrown to the ground unconscious. Rescuers found no trace of Father Lauto save charred remains. The others were all injured.

B.E.S.A. Publications.

Two recently-issued specifications by the British Engineering Standards Association are: No. 279-1927, for flame-proof plugs and sockets, heavy duty, and No. 171-1927, for the electrical performance of transformers for power and lighting. The latter supersedes B.S.S. No. 72-1917, in so far as it applies to transformers for power and lighting having windings insulated with Class A and Class B materials, including auto-transformers and single- and polyphase transformers, but does not apply to instrument and traction transformers. The actual specification is divided into twelve sections, and there are ten appendices which include a great deal of useful information. Definitions of all terms used in the specification are set out in Section 2, and further sections deal with methods of cooling, standard voltages, frequency, classes of rating, &c. Limits of temperature rise for various types of transformers with both classes of insulation are given, and details of high-voltage, performance and type tests are set out in later sections. The last two sections deal with tolerances on stated performances and information to be given on the rating-plate. The appendices include a classification of insulating materials used in the construction of machinery and transformers, and give useful information on service conditions. Methods of measuring temperature-rise and methods of declaring efficiency are dealt with very fully, and formulæ are given for the calculation of inherent voltage regulation at various power factors.

Specification No. 279 deals with apparatus of 100-A capacity, for voltages not exceeding 660. The plugs and sockets described are primarily intended for use in connection with coal-cutting machines and such like portable apparatus in mines. The specification only deals with the dimensions necessary to secure interchangeability between plugs and sockets and with certain electrical and mechanical requirements. It does not specify a fully detailed design. After defining the chief terms used, it gives instructions for connecting the plug and socket to the supply system. An appendix gives the gauges designed to test work made in accordance with the dimensions specified, and it is recommended that manufacturers submit their gauges and a model plug and socket to the National Physical Laboratory for checking. In order to make the specification complete, the British standard definition of flame-proof enclosure (including explosion-proof) for electrical apparatus, from the British Standard Specification No. 229-1926, is included. Recommendations are also given for securing interchangeability of plugs and sockets when an electrical interlock is fitted. Copies of the above specifications may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

British Radiology.

The Röntgen Society and the British Institute of Radiology have each held the necessary statutory meetings, the resolutions for amalgamation have been adopted, and as soon as the legal proceedings in the High Court are completed, the new Council of the joint body will take office in September. It is proposed to hold an inaugural meeting in November, when the Institute will be formally opened, and a two days' congress on November 17th and 18th is contemplated, among the events being the new president's address, an exhibition of apparatus, and a banquet; the exhibition will be open to firms engaged primarily in the X-ray industry. The X-ray and Radium Protection Committee recently revised its recommendations, and its third report will shortly be issued.

Electricity Supply in London.

On Tuesday last the daily Press announced, on the alleged authority of an electricity supply official, that "throughout the West End of London a silent change in the distribution of electricity was effected at midnight on Sunday as part of the scheme for standardising high pressure at 22,000 volts. The change-over took place without the slightest hitch. It was simply a matter of pulling over switches, and using for the first time the cables which have been laid and the transformers which have been constructed under London streets during the last few months. . . . The corps of engineers responsible for the work have been fighting against the clock all the time, for it was considered that the night before Bank Holiday was the best time for the change, there being then less drain on the current generated." The statement appeared in many papers in almost identical wording, pointing to a common origin. Inquiries that we have made in official quarters indicate that there was no ground for the rumour, which is described as nonsensical. It is true that the London electricity supply in the West End is being reorganised by the companies concerned, but no such dramatic change-over is contemplated, and the process of reorganisation is far from complete.

French Railway Electrification.

A railway expert, writing in the *Revue Mondiale*, says the *Financial Times*, estimates that when the electrification of the Orleans Railway Company's main line is completed the coal-saving will amount to 1,500,000 tons per annum. The Orleans Railway has already electrified over 100 miles of its main track, and the fuel economy has been considerable, but it is as yet too early to say what the cost per mile run will be under the new system. With regard to the Midi Railway the main line between Bordeaux and the Spanish frontier has now been electrified. The Midi Co. last year saved 70,000 tons of coal. Within five years the Orleans and Midi lines are expected to be completely electrified.

The Institute of Metals.

The autumn meeting of the above Institute will be held at Derby from September 6th to 9th next, when the proceedings will include the presentation and discussion of a number of papers and visits to works and places of general interest.

German Interconnection Schemes.

According to the *Financial Times*, the linking-up of the great electrical power network which spreads all over Germany proceeds surely but not slowly. It has long been an open secret—now confirmed—that the Rhenish Westphalian Electricity Works have made a connection with the South German stations (220,000 volts) and have thus established an indirect connection with the Bavarian power network. From this station there is a connection with the West Tyrolean works, where the power is produced by means of water turbines. Conferences are now taking place between the Tyrol authorities and the Rhenish Westphalian Works regarding the extension of the Tyrol generating station. The Rhenish Westphalian Works are desirous of constructing new works, in addition to the existing ones, on the Upper Inn, the Pitzgal Ache and the Oetztal Ache, in order to create another great distributing station whence power can be drawn for the West German industrial district, including the Ruhr and Westphalia.

The Engineers' Club (London).

At a meeting of the members of the Engineers' Club, London, on May 27th, 1927, an appeal was made for subscriptions to tide the Club over a temporary difficulty. A special meeting was held on Thursday, July 21st, when Mr. P. F. Crinks, the chairman, announced that the sum of £2,489 had been subscribed or promised, and that an examination of the assets showed that the value of the leases of the Club and annexe buildings to-day was £30,000 more than the value which had appeared in previous statements, and the contents of the buildings had been valued at £23,550. The position was therefore very much better than had been supposed. Arrangements had been made with the first debenture holder which relieved the Club to the amount of £3,750 per annum, and the second debenture holders had agreed to a reduction in the rate of interest which would save the Club £1,600 per annum. Economies were being effected in the management that would effect a saving of £3,000 per annum, and the general amenities of the Club were being improved; the price of bedrooms had been materially reduced.

In view of the statements made by the chairman, the meeting unanimously adopted a resolution expressing confidence in the present Committee and management of the Club, and pledging itself wholeheartedly to assist the Committee over the present difficult position.

Fatalities.

Ernest Tennant (40), farm foreman, whilst working at the White Rose Dairy, New Earswick, near York, on July 23rd, was caught by the revolving belt of the electric motor to a hay chopper and was killed. At the inquest a verdict of "Death by misadventure" was returned.

George Munday, an employé of the Aylesbury Borough Council Electricity Department, was killed by electric shock on July 30th while working on one of the Council's overhead lines at Aston Clinton.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. C. Denison-Pender, vice-chairman of the Eastern Telegraph Co., Ltd., has been elected a director of the National Provincial Bank.

The marriage took place on July 16th, at Manchester, of Mr. Clifford Darbyshire, who is with the Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, and Miss Elsa P. Wright.

Mr. R. Kullman, who was for many years with Messrs. Crompton & Co., Ltd., as inside sales engineer (instruments), has been appointed by Messrs. Landis & Gyr, Ltd., in charge of the Midlands area. Correspondence for him should be addressed for the present c/o the company, at its new factory, Victoria Road, North Acton, W.3.

On July 21st Kelvinator, Ltd., gave a farewell dinner to Mr. Wilcox on his return to the United States. The chairman, Mr. L. G. Hawkins, said that within a year Mr. Wilcox had organised and trained an engineering staff of nearly 100 men, and, in addition, through his efforts, had trained men in each of the 109 authorised Kelvinator depôts now established in all parts of the British Isles. Mr. Wilcox assured the assembly that he was leaving England with many regrets; he had found many friends, and hoped to return before very long.

On the occasion of the British Association meeting the following honorary degrees will be conferred by the Court of the University of Leeds on September 8th:—Doctor of Laws: Sir A. Keith, F.R.S., President; the Duchess of Atholl, and Sir Chas. Parsons, F.R.S. Doctor of Science: Dr. J. S. Haldane, F.R.S., Dr. N. V. Sidgwick, Dr. F. O. Bower, F.R.S., and Dr. R. A. Millikan (California). Doctor of Philosophy: Mr. J. Graham.

The arrival of No. 2 (July) of *The Kipling Journal*, the organ of the Kipling Society which has now 400 members in different parts of the world, notifies the change of the address of the honorary secretary, Mr. J. H. C. Brooking, to 1, Vanbrugh West, Blackheath.

On the occasion of his marriage at Ashton-under-Lyne, on July 19th, to Miss Doris Woodcock, Mr. E. M. Dakin, who is with Messrs. Ferguson, Pailin, Ltd., received from the staff of the company a silver tea and coffee service, from Mr. and Mrs. S. Ferguson a cut-glass flower vase, and from Mr. and Mrs. G. Pailin a 5-valve wireless set.

The Hackney Electricity Committee has granted permission to Mr. A. C. Bostel to advise the Eastbourne Borough Electricity Department on the lay-out and design of its proposed new showrooms. Mr. Bostel will act in conjunction with the borough electrical engineer of Eastbourne

The Times states that Mr. George F. O'Riordan, principal of the Leicester College of Technology since 1924, has been appointed principal of the Battersea Polytechnic in succession to Dr. Robert H. Pickard, who has accepted an appointment as Director of the British Cotton Industry Research Association.

According to an article appearing in the *Western Mail*, Mr. W. A. Chamen, who was appointed engineer and general manager of the South Wales Electrical Power Distribution Co. in 1905, will be retiring from that position probably about the end of the present year, and he will be offered a seat on the boards of that company and of the South Wales Power Co., Ltd.

The Shrewsbury Town Council has decided to pay 200 guineas to the electrical engineer, Mr. C. N. Johnston, for additional services rendered in connection with extensions to the works.

The Gillingham (Kent) Town Council has increased the salary of the borough electrical engineer by £50 per annum.

The Luton Town Council is granting £1,000 to the borough electrical engineer for special services rendered in connection with the development and extension of the undertaking during his 26 years as engineer, and especially during recent years.

Ribble Power Station Sports Club celebrated the recent marriage of Mr. C. Cartmell (elder son of the late Sir Harry Cartmell), chief electrical engineer at the station, and that of Mr. A. W. Young, one of the staff, at a gathering on July 27th. Mr. R. Dickinson (deputy superintendent) presented canteens of cutlery to both as tokens of esteem.

Mr. J. Douglas Knight, borough electrical engineer of Ealing, is to receive an honorarium of £1,000 in recognition of his services in designing the new distributing station at Pope's Lane.

Mr. J. L. Wilson has been appointed sales manager of the British Thomson-Houston Co., Ltd., and has been elected a member of the board.

Councillor S. Brindley has been elected chairman of the Buxton Electricity Committee in place of Councillor W. R. Sanders, resigned.

The Hastings Town Council has appointed Mr. Joseph Savage (assistant electrical engineer and manager under the St. Helens Corporation) as deputy-borough electrical engineer, at a salary of £605 per annum. There were 123 applicants.

The Birkenhead Town Council has appointed Mr. Sam Tillotson, of West Hartlepool, as motor and hiring superintendent in the electricity department.

At Brierley Hill, on July 27th, the marriage took place of Mr. Arthur Hammond Newey, partner in the firm of Price and Newey, electrical engineers, of Birmingham, and Miss Muriel Esme Gifford, of Brierley Hill.

Obituary.—Mr. A. J. Bookham.—The death has taken place of Mr. A. J. Bookham, electrical engineer, Sunninghill. He was 39 years of age, and continued the business established by his father in 1904.

Dr. de Groot.—A *Reuter* dispatch to *The Times* records the sudden death in the Red Sea, following a heart attack, of Dr. de Groot, chief technical expert of the Dutch East Indian Telegraphs, who was on his way to the Telegraphic Conference at Washington.

Mr. A. M. Jack.—The death occurred on Tuesday of Mr. Alexander M. Jack, formerly managing director and deputy chairman of Hadfields, Ltd.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Thomas Laurie & Co., Ltd.—Private company. Registered in Edinburgh, July 25th. Capital, £12,000 in £1 shares (2,000 preference and 10,000 ordinary). Objects: To carry on the business of electrical engineers and contractors, manufacturers and dealers in railway, tramway, electric, magnetic, and other apparatus, &c. The first directors are:—A. Laurie, Campfield, Wellside Place, Falkirk, motor and electrical engineer; T. Wyllie Howie, Falkirk, brick manufacturer. Solicitors: John and W. K. Gair and Gibson, Hope Street, Falkirk.

L. N. Bennett, Ltd.—Private company. Registered July 28th. Capital, £100 in £1 shares. Objects: To acquire the business of an electrical and wireless engineer and dealer now carried on by L. N. Bennett at East Street, Herne Bay, as "L. N. Bennett." The first directors are:—L. N. Bennett (permanent managing director), East Street, Herne Bay; A. B. Carr, 61, Church Avenue, East Sheen. Secretary: Miss C. Beaumont. Solicitors and registered office: Heywood & Ram, 22, Strand, W.C.2.

Fellows Manufacturing Co., Ltd.—Registered as a public company, July 25th. Nominal capital, £175,000 in 250,000 preferred ordinary shares of 10s. each and 400,000 deferred ordinary shares of 2s. 6d. each. Objects: To adopt agreements (1) with Fellows Magneto Co., Ltd., and T. S. Jones, its liquidator, and (2) with the said company, its liquidator, and Langley Agency, Ltd., to develop and turn to account the business of Fellows Magneto Co., Ltd., and to carry on the business of manufacturers, vendors and repairers of and dealers in wireless apparatus and the component parts thereof, and plant, tools, appliances and parts, engines of all kinds, motor cars, airships, aircraft, boats, dynamos, magnetos, accumulators, coils, carburettors, speedometers, and taximeters, motor electricians, ignition specialists, &c. The first directors are:—V. L. Fellows, 3, Gunnersbury Avenue, Ealing Common, W.; D. V. L. Fellows, View Point, 20, North Common, Ealing, W.; G. P. Barker, Travellers Lane, Hatfield; R. A. Yeates, The Promenade, Gravesend, motor trader; H. F. Jackson, Felix Hall, Kelvedon, Essex. Qualification: £500 shares or stock. Registered office: Cumberland Avenue, Park Royal, N.W.10.

Official Returns of Electrical Companies.

Windsor Electrical Installation Co., Ltd. — Capital, £125,000 in 50,000 1st preference, 25,000 2nd preference, and 50,000 ordinary shares of £1 each. Return dated April 6th, 1927. 50,000 ordinary and 23,532 preference shares taken up. £73,082 paid, £450 considered as paid. Mortgages and charges: £2,500. A return of allotments, made up to May 4th, 1927, shows a further £25,000 preference shares allotted as fully paid.

Tyneside Electrical Development Co., Ltd.—Capital, £100,000 in 50,000 preferred ordinary and 50,000 deferred ordinary shares of £1 each. Return dated April 13th, 1927. All shares taken up. £55,000 paid (being £1 per share on the preferred ordinary and 2s. per share on the deferred ordinary). Mortgages and charges, nil.

Standard Telephones and Cables, Ltd. — Capital, £1,000,000 in £1 shares. Return dated June 24th, 1927. All shares taken up. £656,000 paid, £344,000 considered as paid. Mortgages and charges, nil.

Radvaco, Ltd.—Debenture dated June 22nd, 1927, to secure £600, charged on the company's property, present and future, including uncalled capital. Holder:—Betsy B. Blitz, 4, Lynton Terrace, Lynton Road, Acton, W.

Attaix, Ltd.—Debenture dated July 6th, 1927, to secure all moneys not exceeding £500, for which the holder may become liable under a guarantee to the company's bankers, charged on company's property, present and future, including uncalled capital, but excluding 106, High Street, Southampton. Holder: H. Benger, South Western Hotel, Southampton.

County of Durham Electrical Power Distribution Co., Ltd.—Capital, £535,000 in £1 shares. Return dated March 30th, 1927. All shares taken up. £535,000 paid. Mortgages and charges, £250,000.

Cambridge Electric Supply Co., Ltd.—Capital at date of returns, £100,000 in £10 shares (since divided into £1 shares, and capital increased to £260,000 in £1 shares in May, 1927). Return dated March 30th, 1927. All shares taken up. £100,000 paid. Mortgages and charges, £75,000. Return of allotments made up to June 10th, 1927, shows a further 110,000 shares allotted for cash and fully called up.

Flactophone Wireless, Ltd.—Capital, £1,000 in £1 shares. Return dated April 22nd, 1926 (filed March 4th, 1927). 700 shares taken up. £700 paid. Mortgages and charges, nil.

J. L. Maughan & Company, Ltd.—Mortgage dated July 20th, 1927, to secure £350, charged on 29, Carliol Street, and 13, Erick Street, Newcastle-upon-Tyne. Holder: S. Gillis, 14, Humbledon View, Sunderland.

M. Coquantin & Co., Ltd.—Debenture dated July 8th, 1927, to secure £5,000, charged on 37, Drury Lane, W.C. (leasehold), and the company's undertaking and other property, including uncalled capital. Holders: Chamberlain and Co., Ltd., 54, Cleveland Street, Fitzroy Square, W.1.

Clear Hooters, Ltd.—Issue on July 18th, 1927, of £287 9s. 2d. debentures, part of a series already registered.

Eckington Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated June 10th, 1927. All shares taken up. £5,000 paid. Mortgages and charges, nil.

J. F. Smith (Birmingham), Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1926 (filed May 20th, 1927). All shares taken up. £3,000 paid. Mortgages and charges, nil.

Astral Supply Co., Ltd. (formerly Frecastle Electrical Imports, Limited).—Capital, £500 in £1 shares. Return dated December 31st, 1926 (filed May 23rd, 1927). All shares taken up. £500 paid. Mortgages and charges, nil.

Minehead Electric Supply Co., Ltd.—Capital, £35,000 in 15,000 1st preference, 8,000 2nd preference, and 12,000 ordinary shares of £1 each. Return dated May 12th, 1927. 11,970 1st preference, 5,375 2nd preference, and 5,920 ordinary shares taken up. £23,265 paid. Mortgages and charges: £20,297 6s. 8d.

Isle of Thanet Electric Supply Co., Ltd.—Capital, £500,000 in 150,000 ordinary, 282,000 preference, and 68,000 unissued shares of £1 each. Return dated March 24th, 1927. 150,000 ordinary and 282,000 preference shares taken up. £222,000 paid on 222,000 preference shares. £210,000 considered as paid on 150,000 ordinary and 60,000 preference shares. Mortgages and charges: £292,800.

Willey & Co., Ltd.—Capital, £225,000 in 200,000 ordinary and 25,000 preference shares of £1 each. Return dated April 12th, 1927. 175,000 ordinary and 25,000 preference shares taken up. £28,572 paid, £171,428 considered as paid. Mortgages and charges, nil.

J. B. Saunders (1923), Ltd.—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1 each. Return dated May 5th, 1927. 795 preference and 4,000 ordinary shares taken up. £4,795 paid. Mortgages and charges, nil.

Northleach Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 11th, 1927. 1,650 shares taken up. £1,700 paid (including £50 paid on 100 forfeited shares). Mortgages and charges, nil.

Laurence, Scott & Co., Ltd.—Capital, £260,000 in 259,950 ordinary and 50 founders' shares of £1 each. Return dated April 19th, 1927. 230,080 ordinary and 50 founders' shares taken up. £131,775 paid on 131,730 ordinary and 45 founders' shares. £98,350 considered as paid on 98,350 ordinary shares. Mortgages and charges, nil.

Electric Supply Corporation, Ltd.—Capital, £500,000 in 200,000 ordinary, 150,000 preference, and 150,000 new shares of £1 each. Return dated May 9th, 1927. 150,000 ordinary and 150,000 preference shares taken up. £279,000 paid,. £21,000 considered as paid. Mortgages and charges, nil. Return of allotments, made up to June 15th, 1927, shows a further 50,000 ordinary shares allotted for cash.

Tewkesbury Electric Light Co., Ltd.—Satisfaction in full on May 1st, 1927, of debentures dated November 26th, 1910, securing £1,500.

J. P. Hall & Company, Ltd.—Amended satisfaction in full on May 31st, 1927, of debentures dated March 30th, 1926, securing £46,666 13s. 4d. (The original satisfaction gave the date of the discharge as June 16th, 1927.)

United Electrical Company (Birmingham), Ltd.—Particulars filed of £1,000 debentures authorised July 19th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Naylorgraph, Ltd.—G. H. Warmington, of 73, Basinghall Street, E.C., ceased to act as receiver or manager on July 19th, 1927.

City Notes.

Victoria Falls & Transvaal Power Co., Ltd.

The Marquess of Winchester (chairman) presided at the annual meeting of this company on July 28th. In presenting the report and accounts (*vide* ELEC. REV., July 22nd, p. 154) he said that the net profit of £371,344 was the highest in the company's history, and it had enabled them to raise the ordinary dividend to 15 per cent. During the year the sales of electricity and compressed air both rose by about 6 per cent., and there were indications of continued growth. None of the mines of importance which they served ceased operations during the year, and the increase was due to a general growth of the demand of the consumers. Their prices had been lowered, in accordance with the decreased operating costs of the Witbank station, and a further reduction would automatically result from the more complete use of that station. Certain additions and renewals had been undertaken, including the construction of a 20,000-kW turbo-generator set for Vereeniging to replace the machine which was damaged in the previous year. The Witbank station came into operation with three machines during the year, an initial capacity of 80,000 h.p. It had fully justified the expectations of reliability and economy. The station was loaded so as to give the maximum output and had given the company the requisite spare plant on the Rand, enabling the complete programme of overhauling to be carried through. It had been decided to install a fourth set with the necessary boilers, and in consequence the receiving station at Brakpan was being extended. The co-operation between the company and the Electricity Supply Commission had proved satisfactory. The company had always been prepared to develop its rights at the Victoria Falls when a workable scheme was found, and lately some interest had been shown in the matter. Now the Government of Northern Rhodesia questioned the validity of the company's rights, holding that in the public interest development should not be indefinitely locked up. The company regretted that it had been unable to develop the Falls, but the vast size of the country, the scattered population, and the distance of the Falls from the coast had made it impracticable. In conclusion, the chairman said that Mr. Bernard Price, O.B.E., had been appointed to the position of general manager and chief engineer in South Africa, in succession to the late Major Bagot. The report and accounts were adopted.

East Anglian Electric Supply Co., Ltd.

The annual meeting of this company, whose report was reviewed in our last issue (p. 194) was held on July 27th. Mr. F. M. Rogers (chairman), who presided, referred to the recent issue of 15,000 ordinary shares, making the subscribed capital £39,793. He said that nearly £18,000 had been spent on capital account during the year. The company's Parliamentary Bill empowering it to supply electricity in all the unallocated districts of Norfolk and Suffolk had been approved by Select Committees of both Houses, but the introduction of certain amendments would probably lead to delay. He regretted that the municipalities of Norwich, Ipswich, Great Yarmouth, and King's Lynn had opposed such a desirable measure; their action had involved the company and themselves in heavy and useless expense. The programme contained in the Bill would call for further large outlay, and the directors accordingly proposed to raise the nominal capital to £250,000 by creating 150,000 ordinary shares of £1 each. Plans for the extension of the h.p. transmission line from Braintree to Sudbury *via* Halstead had been completed, and they would soon be able to supply Halstead and improve the facilities at Sudbury. Lord Cranworth and Mr. F. L. Bland had joined the board, while the retiring directors, Messrs. Bradbrook, Freeman, and Goodall, had promised to continue as unofficial advisers.

The report and accounts were adopted, and later the proposed increase in the capital was approved.

Yorkshire Electric Power Co.

The directors' report for the half-year ended June 30th states that interim dividends at the rate of 6 per cent. per annum have been declared on the preference and ordinary capital. On June 29th last the Company's Act received the Royal Assent. By this the capital is increased from £4,000,000 to £6,000,000, and the borrowing powers from one-third to one-half of the issued capital. The initial installation at Ferrybridge has been completed, and the two turbo-alternators of a total capacity of 50,000 h.p. have been set to work. Further additions have been made to the 33,000-V transmission system connecting the Thornhill and Ferrybridge stations, and establishing new distribution centres of Crigglestone, Rodley, and Shipley. Apart from the effect of last year's coal dispute, there has been a satisfactory increase in the sale of electricity as compared with the corresponding half-years of 1925 and 1926. It is expected that a further issue of ordinary shares will be made next February.

Electrical Distribution of Yorkshire, Ltd.

The report for the six months ended June 30th states that an interim dividend at the rate of 9 per cent. per annum has been declared. An issue of 300,000 ordinary shares made last March, at 25s. per share, was subscribed more than twice over. The Ardsley, Methley and District Electricity Order has been confirmed by Parliament. The company has now an area of 1,080 square miles, with a population of 733,000. The number of consumers continues to grow rapidly; a marked feature of development is the increased use of electricity for heating, cooking, and other domestic purposes.

Electric Supply Corporation, Ltd.

A meeting was held on Tuesday last to consider resolutions providing for the conversion of up to 100,000 of the 150,000 ordinary shares created last April into 6 per cent. cumulative preference shares ranking *pari passu* with similar existing shares. The conversion is necessitated by an arrangement for the acquisition of a controlling interest in certain other companies. The resolutions were approved.

Consolidated Gas, Electric Light and Power of Baltimore.

A dividend of $\$\frac{1}{2}$ per share has been declared on the common shares for the quarter ending September 30th.

Australian Company.

Electric Light and Power Supply Corporation, Sydney (N.S.W.).—The profit for the year ended April 30th last was £109,515, as compared with £104,026. The dividend is maintained at 10 per cent. The number of consumers increased by 1,957 to 21,267. The capital expenditure during the year was £71,633.

French Company.

The *Compagnie Générale d'Entreprises Electriques* reports a net profit of 1,087,000 fr. for 1926; the ordinary dividend is 12 per cent.

City of Buenos Aires Tramways Co. (1904), Ltd.

A dividend of 1¼ per cent. has been declared in respect of the quarter ended June 30th.

Rushden and District Electric Supply Co., Ltd.

An interim dividend of 3½ per cent. on the old shares has been declared, and an interim dividend on the new shares will be paid in accordance with the terms of issue.

Northampton Electric Light and Power Co., Ltd.

The directors have declared interim dividends of 2½ per cent. on the 5 per cent. preference "B" shares and 4 per cent. on the ordinary "B" shares.

County of London Electric Supply Co., Ltd.

The directors have declared an interim ordinary dividend of 3 per cent. This represents 7 per cent. on the ordinary capital as existing before the capitalisation of reserves and compares with 5 per cent. paid last year.

North Wales Power Co., Ltd.

Presiding at the annual meeting on July 28th (in the absence of Mr. K. M. Clark (chairman), Mr. S. G. Bibby reviewed the report (*vide* our last issue, p. 194) and said that the item in the balance sheet, land, buildings, machinery, plant and transmission lines, had increased by £413,523, showing that a great deal of construction work had been carried out during the year. The investment account showed a decrease of £409,706, owing to payments to the various contractors. The holders of the preference shares had agreed to forgo their dividend in order to strengthen the company's financial position. The company now had about a million pounds in hand for the completion of the construction programme. Their sales of purchased power had shown a considerable increase; it was hoped to have the Maentwrog water-power station in active operation early next year. Large sums of money had to be expended upon hydro-electric works before any return could be obtained. They were nearing the end of the work upon the transmission system in the northern part of their area, but they had encountered difficulties regarding wayleaves for the lines from Wrexham to Crewe and Oswestry. With the aid of the Ministry of Transport they believed that they had now overcome the difficulties, and that both the lines would be placed in service in the next few weeks. The work on the new dams was approaching completion, the machines were ready for delivery, and they hoped to be able to inform the next meeting that the new hydro-electric power was in full operation. The company was now supplying electricity to practically all the seaside resorts of North Wales, and to slate, granite, and limestone quarries in the district. There was no cessation of supply during last year's general strike. The question of reciprocal supplies with the coal mines had made considerable progress. The directors had in mind the need for a cheap method of distribution in rural districts. All those developments had cost a considerable sum, but the directors were confident that the shareholders would, in the near future, receive their reward. The report and accounts were adopted and at a subsequent extraordinary meeting certain of the articles were modified.

Richardsons, Westgarth & Co., Ltd.

The directors report a small loss on trading for the year 1926, but according to the *Financial Times* they propose to double the dividend. Working, after crediting interest, &c., received, gave a loss of £1,689, compared with a profit of £11,366 for 1925. The directors have taken £4,440 from reserve, and after providing debenture interest and directors' fees there is available, after crediting £24,466 brought in, £23,564. The preference dividend to October 31st, 1926, requiring £21,000, has been met from the reserve, and, in view of the large sums set aside for reserves in past years, the improved order book and the increased business likely to accrue from the agreement referred to below, the directors feel justified in recommending a dividend of 6 per cent. on the ordinary capital, carrying forward £2,564. Since the close of the period, important contracts have been secured both for internal combustion and steam engines for delivery in 1927 and 1928. These orders have made it possible to reopen both the Middlesbrough and Sunderland works, both of which were closed during the greater part of the year. An agreement has been entered into with Messrs. Brown, Boveri & Co., of Baden, Switzerland, which gives the company the exclusive right to manufacture in this country their steam turbines and electric generators.

Alderley and Wilmslow Electric Supply, Ltd.

The report which was presented at last week's annual meeting showed a net profit of £4,852 for the year ended December 31st last. This result was obtained after providing for debenture and loan interest, preference dividend, depreciation, &c., and adding £826 brought forward. A sum of £2,000 is placed to general reserve, and a final dividend of 5 per cent., free of tax, is paid on the ordinary shares, making 8 per cent. (tax free) for the year. A balance of £1,252 is carried forward. Mr. F. E. Gripper has retired from the board and his place as chairman has been taken by Mr. A. N. Rye, M.I.E.E.

Tyneside Tramways and Tramroads Co.

During the half-year ended June 30th, the surplus of receipts over expenses was £1,597, plus £79 brought forward and £200 transferred from special reserve account, making £1,877. After deducting interest on mortgage, loan, &c., £1,822, £54 remains to be carried forward. The traffic receipts for the half-year decreased by £1,171, as compared with the corresponding period of 1926, which is due to the continued depressed state of industry in the district, accentuated by the competition of motor-omnibuses.

Brompton and Kensington Electricity Supply Co., Ltd.

The directors announce an interim dividend of 10d. per share less tax on the ordinary shares for the half-year.

Charing Cross Electricity Supply Co., Ltd.

The directors have declared an interim dividend on the ordinary shares of the West End Undertakings for the half-year ended June 30th at the rate of 9½d. per share.

Chili Telephone Co.

The report for the year ended March 31st, 1927, states that the total number of stations at the end of the year was 26,372, an increase of 1,578 for the year. The gross revenue from all sources was £254,305 and the gross expenditure £173,720, leaving a profit of £80,586. Adding £3,938 brought forward, there remains available £84,524. The directors recommend a final dividend of 3s. per share, free of tax (making, with the interim dividend, 6 per cent., free of tax, for the year), placing £25,000 to depreciation and renewals account, and carrying forward £10,024.

Cork Electric Tramways and Lighting Co., Ltd.

Resolutions have been passed by the shareholders authorising the division of the £10 preference and ordinary shares into £1 shares, and the changing of the company's title to "The Cork Electric Supply Co., Ltd." A confirmatory meeting is to be held on August 8th.

An interim dividend of 6s. per share has been declared on the ordinary shares, as in 1926.

Bristol Tramways and Carriage Co., Ltd.

The directors have declared a dividend for the half-year ended June 30th at the rate of 3 per cent. on the ordinary shares.

South London Electric Supply Corporation, Ltd.

An interim dividend of 3 per cent. has been declared on the ordinary shares. This is equivalent to £5 14s. per cent. on the old ordinary shares, as compared with 5 per cent. last year.

South Metropolitan Electric Light & Power Co., Ltd.

An interim dividend of 3 per cent. on the ordinary shares is announced. This is equivalent to £7 4s. per cent. on the old ordinary capital; last year the interim dividend was 5 per cent.

Stock Exchange Notices.

Dealings in the undermentioned have been specially allowed by the Committee under Rule 159:—

Bogotá Telephone 114,886 new ordinary shares of £1 each, issued at £1 5s. per share, of which 7s. is paid, Nos. 143,608 to 258,493.

Sevenoaks and District Electricity.—10,000 8 per cent. cumulative preference shares of £1 each, fully paid, Nos. 34,597 to 44,596.

Westinghouse Brake & Saxby Signal Co., Ltd.

The company has notified its intention to redeem at par, on November 1st next, the whole of the outstanding 8 per cent. first mortgage debentures, amounting to £316,950.

Stocks and Shares.

TUESDAY EVENING.

THE Underground Electric Railways of London will hold a meeting, on Friday in this week, at which the proprietors of the company's 6 p.c. Income bonds are to be asked to agree to the Board's proposals for modifying the character of the security. Comment has been made here upon the hostility that the scheme provoked. Some of the objections undoubtedly carry weight. By a slight compromise, the company's directors could meet the opposition in such manner as would give general satisfaction. This may be offered, for the Board are understood to be far from assured that their present proposals will command the required amount of support to carry out the scheme. It would savour of anti-climax to the liveliness of the discussion raised around the subject if, at the meeting, a quorum could not be formed. Yet such contingency is at least possible at any meeting held during the August Bank-holiday week. The price of the Income bonds has not recovered from its reaction to 101. The £1 shares at 18s. 9d. ex dividend are a few pence easier on the week.

Metropolitan Consolidated picked up 20s. after its previous drop of £4 caused by reduction of the interim dividend from 1¼ p.c. to 1 p.c. Districts remain as buoyant as ever. The Home Railway market received another nasty shock by the passing by the London and North-Eastern Railway of the interim dividend upon its second preference stock, which is still in the Trustee List for the time being. The directors hope that the company will be able to pay the full year's dividend on this second preference stock at the end of the twelve months, but the postponement has caused bitter dis-

appointment to a large number of investors, and led to severe falls in the prices of the company's preferred ordinary, as well as in the second preference stock. The Great Western did better with its dividend than was expected; the other steam railways matched the advance estimates.

Anglo-Argentine Trams.

Anglo-Argentine Tramways First preference are ½ better on private advices from Buenos Ayres regarding the present relationship between the company and the Municipality. The position is declared to be better than it has been for some time past; permission for the company to increase its rates is thought to lie within early possibility. Similar hopes have been current, of course, in fairly recent days, and have failed to materialise, but the market in the shares is certainly better. The Mexican bonds and shares have gone back, with the exception of Mexico Tramways Common, which are up to 26. The company's 5 p.c. bonds at 78 have lost 2½ points, and Mexican Light issues weakened. Brazilian Tractions added a further 4 to their gain of an equal amount last week. The preferred are up to 144. British Columbia stocks continue to gain ground. At 8s., Kalgoorlie Electric Power shares are 9d. better. It was suggested last week that a purchase at the then price of 7s. 3d. might be reasonable for the use of money that its possessor could afford to play with.

London Trams.

Attention is veering round again, it is very interesting to note, in the direction of London tramways descriptions. London United Tramways debenture is 2 higher: London and Suburban Traction preference put on 9d.: ordinary shares in this group are being enquired for, current prices of the last-named being held to represent little more than option-money. The reason for this enquiry is the same as that reflected here some time ago in answer to the jeremiads of the many who can see no future, for trams, other than that of extinction by exhaustion. Lord Ashfield, who usually speaks sound sense, is far from sharing the gloomy view. In more than one of his speeches made last spring, he plainly hinted at a determination to put the trams upon a better-paying basis. The resurrection of the Electric Railways of London £1 shares is an example of what metamorphosis can be made through the process of time and skilful management. The condition of the tramways companies is such that it may yet be long before they attain dividend-earning capacity. Many people maintain that trams are doomed. But there are other folk who foresee a fairer future, and these are they whose purchases begin to make their effect felt upon share-prices, recovery in which has already started.

Good Electric Supply Dividends.

London electricity supply shares are a good market on account of the various interim dividend declarations. The County of London group has done remarkably well. Allowing for the increased capitals that arose out of capitalising the companies' reserves and distributing new shares by way of bonus, advanced interim dividends are announced by the County Company itself, the South London, and the South Metropolitan. No changes have been made in the nominal quotations for the shares, but the tendency is harder. City of Londons are 9d. up at 28s. 3d. Charing Cross hold their gain at 25s.; the company is paying an interim dividend on the ordinary shares of the West End Undertaking, of 9½d. less tax, against 1s. 6d. a year ago, before the share bonus had increased the capital. Kensingtons at 25s. 6d., St. James and Pall Mall at the same price, have both regained the dividends, of about 6d. per share net, deducted last week.

Electric Supply Corporation.

Metropolitans reverted to 30s. Edmundson's at 33s. 9d. ex dividend, are higher by the amount of the distribution. Of the provincial shares, Bournemouth and Poole ordinary went back to 58s. 3d. Electric Supply Corporations remain at 32s. The company held a meeting to-day, Tuesday, in order to pass a resolution providing for the conversion of any number up to 100,000 shares, of the 150,000 new shares created last April, into 6 p.c. cumulative preference. These new shares are to rank in all respects with the 150,000 now dealt in, the price of which is 21s. South Wales Power 6 p.c. first debenture has advanced to 100¼. The Yorkshire Electric Power Company will make a new issue of ordinary shares next February.

Equipment Shares.

English Electric preference are flat at 10s., showing a fall of half-a-crown. Telephone Manufacturing have lost three-halfpence at 6s. 3d. Otherwise the equipment shares are firm, with British Aluminium better at 45s. 9d., General Electric at 30s. 6d., Enfield ordinary at 78s. 3d., and Crompton ordinary at 15s. 6d. Amongst cable stocks a rise of 20s. in Great Northerns to 29½ is balanced by a fall of equal amount in Indo-Europeans at 44½. Eastern Telegraph ordinary stock shed a couple of points to 178½. United River Plate Telephones have again surmounted £10. On the other hand, Orientals gave way to 2½. Business in Marconis is languid, the price of the parent company's shares revolving around 18s. 9d., while Canadians are the turn harder at 6s. bid. Of the fixed-interest stocks, Commercial Cable 4 p.c. debenture is up to 76½. The iron and steel market shows a rise in Vickers: otherwise the list is somewhat uninteresting. Rubber shares continue very quiet.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Aug. 2 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	58/3	—1/6	4 16 1
Brompton Ordinary	£1	10	8¾	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	8½	26/-	—	5 7 8
do. do. 4½ Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	12	8¾	25/-	—	5 12 0
City of London	£1	15	10	28/3	+9d.	4 19 1
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	30/6	—	5 5 0
County of London	£1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	£1	8	10	33/9xd	+1/-	5 18 8
do. 7% Pref.	£1	6	7	24/6	—	5 14 8
Elec. Supply Corporation	£1	10	10	32/-	—	6 5 0
Kensington Ordinary	£1	15	8	25/6xd	+6d.	5 9 10
Lancs. Light and Power	£1	7½	7½	26/-	—	5 15 5
London Electric	£1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	£5	6	6	5⅝	—	5 7 10
Metropolitan	£1	11	5	30/-	—6d.	4 13 4
do. 4½% Pref.	£1	4½	4½	17/-	—	5 8 6
Midland Counties	£1	5½	6	21/6	—	5 11 7
Newcastle-on-Tyne Ordinary	£1	7	5	22/-	—	4 10 11
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	10½	—	5 17 1
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	8	25/6xd	+6d.	5 9 10
South London	£1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	£1	7	7	1½	—	6 8 0
Urban Ordinary	£1	7	7	25/-	—	5 12 0
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	15	8½	25/6	=	5 9 10
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/-	+3d.	7 2 10
Yorkshire Elec.	£1	8	8	30/-	—	5 6 8
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	54½xd	+1	5 10 2
do. District	,,	3½	3½	64½	—	5 8 6
Underground Electric	£1	Nil	1½	18/6xd	—3d.	1 11 7
do. do. Income	Bonds	6	6	101	—	*5 18 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	109	—	5 16 6
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	£1	8	10	46/3	—	4 6 6
Chili Telephone	£5	5	6	7⅞	—	3 17 5
Eastern Extension	£10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	178½	—2	*5 12 1
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 7 5
do. do. Pref.	£10	6	6	11	—	5 8 1
Great Northern Tel.	£10	20	20	29½	+1	7 0 4
Indo-European	£5	8½	10	44½	—1	*5 7 6
Marconi	£1	Nil	Nil	18/9	—	... ...
Marconi-Marine	£1	7½	8½	26/3	—	6 13 4
Oriental Telephone Ord.	£1	12	12	52/6	—1/6	*4 9 4
United R. Plate Tel.	£5	8	8	10½	+½	*3 19 0
Western Telegraph	£10	10	10	17½	—	*5 14 3
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8 7/16	+⅛	8 0 0
do. do. 2nd Pref.	£5	6	6	8 7/16	—	8 14 6
do. do. 5% Deb.	Stock	5	5	72½	—	6 17 11
British Electric Traction Ord.	,,	8	8	119½	+½	6 14
do. do. 6% Pref.	,,	6	6	119½	+1	6 14 0
Brazil Traction	£100	5	6	174	+4	3 9
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	88½	—	5 18 0
do. do. Preferred	...	6½	6½	125	+1	5 0 0
do. do. Deferred	,,	8	8	158	—	*5 1 3
do. do. Deb.	,,	4½	4½	79½	—	5 6 11
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	8/3	+9d.	Nil
London United Tram. Deb.	Stock	4	4	53½	+2	7 19 5
Mexico Trams, 5% Bonds	—	5	5	78	—2½	6 8 2
Mexican Light Common	£100	Nil	Nil	40	—2	Nil
do. Pref.	£100	Nil	Nil	65½	—2	Nil
do. 1st Bonds	—	5	5	72½	—	6 17 0
Yorkshire (West Riding)	£1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£—	13	13	52/6	—	4 19 1
British Aluminium Ord.	£1	12½	10	45/9	+9d.	4 7 4
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	£1	15	15	68/9	—	4 7 3
Brush Ord.	£1	10	10	26/3	—	7 12 4
Callenders	£1	15	15	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	15/6	+6d.	... ...
Edison-Swan	£1	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85½	—	5 17 0
Electric Construction	£1	10	7½	25/-	—	6 0 0
Enfield Cable Pref.	£1	7½	7½	25/-	—	6 0 0
English Electric	£1	Nil	Nil	8/9	—	... ...
do. do. Pref.	£1	8	—	10/-	—½	... ...
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	7½	7½	30/6	+6d.	4 18 4
Henley	£1	20	25	98/3	—	5 4 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	17½	12½	48/9	—	5 2 8
Met.-Vickers Ord.	£1	8	8	27/6	—	5 11 4
do. Pref.	£2	8	8	2⅜	—	6 14 9
Siemens Ord.	£1	7½	7	26/6	—	5 9 10
Telegraph Construction	£12	10	10	27½	—	*4 6 5

* Dividends paid free of Income Tax.

Italian Electrical Development.

The latest and largest installation formally inaugurated.

All generating machinery made locally.

(From Our Special Correspondent.)

ANOTHER of those important electrical undertakings which are gradually making Italy famous throughout Europe, and are attracting the attention of engineers and contractors in the New World, has recently been inaugurated with fitting ceremony at Chiavenna, near Como, on the direct railway route to Colico. The site is also near the Liro Valley—Valle San Giacomo—which is strewn with fragments of rock, a wild-looking district softened, however, by the luxuriant foliage of the chestnut trees, thousands upon thousands in number, which at this period of the year are in full bloom. Nowhere in Italy is the rich luxuriance of vegetation more remarkable; and here—beyond Pianazzo—is found the Madesino forming a magnificent waterfall 650 feet in height.

Amid such romantic surroundings, the young and popular Crown Prince of Italy has just opened the latest of the hydraulic installations—to be known, hereafter, as that of the Liro Inferiore or Lower Liro river, which, descending the valley of San Giacomo, runs nearly north and south from the pass of the Splügen, thus affording one of the most direct lines of communication across the Alps.

The Liro Inferiore installation, with its central station at Mese, forms part of a large group of electrical plant for the complete use of the hydraulic basin of the Rivers Liro and Mera (or Maira) above Chiavenna. This undertaking is one of the largest of its kind not only in Italy, but in Europe.

The complete installation comprises six stations, with a total power of 220,000 kW, producing together 650,000,000 kWh per annum; two large storage reservoirs, one located at Lake Truzzo (2,080 metres), with a capacity of 15,000,000 cubic metres, and the other at Pian di Spluga (1,900 metres), with a capacity of 28,000,000 cubic metres; and in addition some other minor construction works.

The largest of the stations—that of Liro Inferiore—will alone furnish annually more than 300,000,000 kWh (150,000 kW). For the time being one-half only of the plant to be erected or, say, about 105,000 h.p., has been installed.

The intake is situated at Pian di Campodolcino, near Prestone (1,055 metres). The construction comprises a concrete dam, fitted with four iron sluice gates worked by electricity. The intake itself is of the surface type, and includes six openings furnished with hand-operated sluice gates. From the intake the water passes into a settling tank, and thence to the derivation canal. In the construction of these works 28,000 cubic metres of excavation has been carried out, and 21,500 cubic metres of reinforced concrete has been used.

The canal, which is 9,910 metres in length, is in the form of a tunnel, and has a capacity of 18,000 litres per second. To carry out this part of the work about 85,000 cubic metres of rock excavation had to be undertaken. At the entrance to the tunnel there have been installed a group of Gregotti siphons and a sediment escape. Towards the end of the tunnel there is a large tank, 100 metres in length, divided into sections of 35 square metres, and fitted with a Dufour screen, for the extraction of sand. At the exit from the sand-screen there is placed another set of Gregotti siphons for the better control of the water overflow, and immediately beyond the tunnel there is a reservoir 700 metres long with a capacity of 16,500 cubic metres of water, a volume which allows the station to generate a load greater than the capacity of the canal. At the end of the tunnel is the fore-bay at Cigolino, above the Mese power house. From this point there are two tunnels of circular section, 2.70 metres in diameter, cut out of the living rock and running parallel at a distance apart of 54 metres. The gradient varies according to three levels; the first section is vertical, 60 metres long, the second has a fall of 0.70 metre for a length of 1,200 metres; and the third section is practically horizontal, with a length of 220 metres.

At the end of each tunnel are placed three pipes, 18 metres apart, each of which serves a group of generators. To convey the water at the maximum pressure of 75 atmospheres, pipes are employed made of thin corrugated iron with a diameter of 1.80 metres, bound with steel wire of high tensile strength. This system has been introduced by Messrs. Ferrerio and Marinoni, who have already used it on the Edison plant at Ovesca, where it is said to have proved very successful.

In the machinery room of the power station, which has a length of 135 metres, there have been installed three groups of generators. Each group consists of a Pelton turbine of 35,000 h.p., to work with a head of 750 metres; and a 30,000-kVA three-phase alternator, with direct-coupled exciter, capable of generating current at either 42 or 50 cycles per second.

The greater part of the machinery employed upon this installation has been made in Italy. The turbines are the most powerful built in that country up to the present time. They have been constructed at the works of the Costruzioni Meccaniche Riva. The alternators were built by the Tecnomasio Italiano Brown-Boveri, and are said to be the largest as yet constructed in Italy. For the power-house auxiliary services, two groups of 900 h.p. are provided.

Electrical energy will be produced at 8,000 volts, and then transformed to 140,000 volts by means of three-phase, 30,000-kVA transformers, one transformer being allotted to each group of generators.

The energy thus produced will be distributed by means of 140,000-V high-pressure lines, the maximum voltage employed in Italy, on a system which was first adopted by the Società Interregionale Cisalpina on its lines at Brugherio (Milan-Reggio Emilia), and which has worked without occasioning trouble since it was first installed in June, 1923. This will form part of the high-pressure line from Mese to Brugherio-Reggio Emilia-Bologna (362 km.). Another high-pressure line will run to Arquata Scrivia, a distance of 204 km.; here is erected a large sub-station belonging to the Edison company, which supplies energy from its station at Ovesca to the Italian State railways.

The Edison Company is responsible, through its subsidiary, the Società Elettrica Interregionale Cisalpina, for the works described above. With a capital of about 1,500,000,000 lire the company has installed in its various central stations machinery with an output of 750,000 kW; during the past year its production has exceeded 1,800 million kWh, or, say, one-third of the energy produced in the entire country.

Italian Trade and Industry.

Continued Electrical Advance.

THE Department of Overseas Trade has issued a report upon the commercial, industrial, and economic situation in Italy, dated March, 1927, by Messrs. E. C. Donaldson Rawlins and H. C. A. Carpenter, respectively Commercial Counsellor and Commercial Secretary to the British Embassy, Rome. (Stationery Office, 3s. 6d. net.)

The authors state that Italy's desire to increase exports and thus better her general economic position is illustrated by the fact that in October last, for the first time for over 60 years, the exports exceeded the imports. The Government has intensified its policy of exploring every means by which home production can possibly be stimulated, and every effort is being directed towards the discovery of local minerals and raw materials to offset the necessity of imports from abroad. The public has been informed that it must do its part by buying in the home market. Currency deflation will cause even the soundest and largest concerns to pass through a critical period; Italian industry must therefore find new outlets and markets, and there is evidence that no stone is being left unturned in the search. Credit is at present very restricted, there is a dearth of liquid capital, and many industries and undertakings are in need of new money. During 1926 a number of large loans were floated abroad—mainly in the United States. Three electrical concerns each raised $10,000,000 in New York in 1926; the Soc. Adriatica di Elettricità, the Soc. Generale Elettrica dell' Adamello, and the Soc. Edison, while smaller dollar loans were obtained by three other companies. During the year electrical companies as a whole increased their capital by 973 million lire, by far the largest increase of any group.

Industry and Trade.

Influenced by the general inactivity of the market, and by the depression in other industrial branches, the Italian engineering industries were less prosperous last year than in 1925. Some branches, however, such as shipbuilding, were very active during the year. The electro-chemical industry was normally active, apart from a slight reduction in output by certain undertakings. The production of explosives increased considerably owing to the demand for them for mining in hydro-electric and port works. The production of copper ore increased by nearly 60 per cent., but the output was far below the needs of the expanding hydro-electric industry.

An appendix to the report contains particulars of Italy's foreign trade during the past three years. In the only two cases in which Great Britain appears among the electrical items a decrease is shown. The statistics which follow this review have been specially compiled for us and are in greater detail than those given in the report.

Electrical Development.

The report says that the present tendency is to concentrate hydro-electric generating plant in large stations. There are very few small undertakings under construction, and although this applies to the large undertakings too, their aggregate capacity is considerably higher than that of the stations under construction in 1925, the respective figures being 775,375 h.p. and 381,126 h.p. In 1921 there were only three stations of more than 20,000-h.p. capacity under construction, the total being 76,324; in 1926 the number was 13, and the aggregate capacity 502,187 h.p. Of these the undertaking with the greatest head (380 m.) is that in the valley of the Liro, the flow being 5,800 litres per second; the smallest head (99 m.) is at the Lago Morte, the flow being 33,000 litres per second.

The important hydro-electric works of the "Sila," in Calabria, which are progressing satisfactorily, will include three reservoirs with capacities of 150, 60, and 66 million cu. metres. One of these, the Ampollino, is almost complete and will serve three power houses, the largest of which will have plant of 50,000 kW. The "Sila" works will eventually provide 170,000 kW, producing about 850 million kWh annually.

The total water storage is estimated at 800 million cubic metres, but this has proved inadequate and several large steam stations have been erected or are projected. The Piedmontese group—the Adriatic, Tuscan, and Campania companies—are all building large steam power stations as stand-bys during the dry season. A consortium formed by the Edison, Conti, Adamello, and other Lombard companies, is to erect a 100,000-kW station at Genoa. The Ministry of National Economy was authorised by Decree last year to grant subsidies for the erection, reorganisation, and working of thermal stations using national fuels. The subsidy is not to exceed 50 lire per annum per kW, and may not be paid for more than ten years.

The total consumption of electricity during 1926 was estimated at over 9,000 million kWh; during the last five years the average annual rate of increase has been 13 per cent. The engineering industries consumed just over half of the total; the textile industries 13 per cent.; the electrochemical and electrometallurgical industries 11 per cent.; lighting 9 per cent.; traction 8 per cent.; and food industries 8 per cent.

Electricity in Agriculture.

The use of electric power for driving agricultural machinery has been practised in Italy for over 30 years. Throughout the valley of the Po its employment in agriculture is general, for there many transmission lines have been erected. In the centre and south, where the lines are not so widespread, the use of electricity is occasional. The most important applications are in connection with drainage and irrigation works; the most numerous are for ploughing, and then for rice drying, forage baling, cheese and butter making, rice husking, forage drying, the various processes of oil and wine making, starch manufacture, milling, timber sawing, &c. Some eight electrical companies specialise in putting up power stations, plant and transmission cables to supply agriculture with electric power, and farmers are said to appreciate the conspicuous technical and economic advantages which they can derive from its use. Last year an "Istituto Frutticoltura e di Elettrogenetica" was formed, one of whose objects is "the application of electricity for stimulating agricultural production, particularly with regard to fruit."

Railway Electrification.

By the conversion or construction of a further 59 km. during 1926, the total length of track of electric railways was brought to 914 km. by the end of the year. The work on the new Bologna-Florence line was almost completed and expected to be brought into use during the first half of this year. The distance between the two cities will thereby be shortened by 36 km. and there will be a double track instead of a single one, with wider curves and less severe gradients. The new coast line between Rome and Naples is expected to be opened for traffic towards the end of this year; at first only a part of the line will be operated electrically.

Communications.

Although 1,538 telephone circuits, comprising 36,700 km. of line, have been handed over to private enterprise, the State still operates 266 interurban and international circuits (38,650 km.), and the operation during 1926 was successful.

A new cable has been laid between Anzio and Barcelona, passing through the Straits of Bonifacio. This cable will be continued by way of Malaga to join up with the existing Italian Atlantic cables. Telephone communication has been established between Rome and Zara, use being made of the submarine telegraph cable.

A committee has been set up for the control of the broadcasting services, and in addition to this control the committee is charged with examining and reporting on the most suitable methods to be adopted for the development of broadcasting from the technical, artistic, and educational points of view.

Imports and Exports, 1925 and 1926.

THE following statement, showing the imports into and exports from Italy of electrical goods during 1926 has been compiled from the recently-issued official trade statistics. The figures for 1925 are added for purposes of comparison and notes of any increases or decreases are made:—

Imports.

	1925. Quintals.	1926. Quintals.	Inc. or dec. Quintals.
Electric generators and motors—			
Total	24,000	38,000	+14,000
From Austria	1,400	1,200	− 200
„ Germany	12,000	19,000	+ 7,000
„ Great Britain ...	800	700	− 100
„ Switzerland ...	2,500	4,200	+ 1,700
„ Hungary	4,500	5,000	+ 500
„ United States ...	650	2,000	+ 1,350
Static transformers—			
Total	11,000	7,000	− 4,000
From Austria	500	100	− 400
„ Germany	7,000	3,000	− 4,000
„ Germany (Reparation account) ...	—	500	+ 500
„ United States ...	600	100	− 500
Electricity meters—			
Total	5,700	6,500	+ 800
From Germany	4,500	5,000	+ 500
„ Switzerland ...	900	900	—
**Telegraph and telephone apparatus—*			
Total	2,600	6,200	+ 3,600
From Germany	1,200	4,000	+ 2,800
„ Germany (Reparation account) ...	40	30	− 10
„ United States ...	130	330	+ 200
„ Belgium	120	500	+ 380
Carbons, electric—			
Total	51,000	37,000	−14,000
From Germany	19,000	18,000	− 1,000
„ Jugo-Slavia ...	3,000	1,500	− 1,500
„ United States ...	24,000	15,000	− 9,000

* Including radio apparatus 1,100 q. in 1925 and 1,600 q. in 1926.

	1925. Quintals.	1926. Quintals.	Inc. or dec. Quintals.
Insulators, porcelain, &c.—			
Total	21,000	9,000	−12,000
From Germany	12,700	3,600	− 9,100
„ United States ...	4,400	1,400	− 3,000
„ France	3,500	3,000	− 500
Accumulators—			
Total	1,400	800	− 600
Other electrical apparatus and parts—			
Total	14,000	15,000	+ 1,000
From France	1,600	2,800	+ 1,200
„ Germany	8,700	8,000	− 700
„ Germany (Reparation account) ...	10	270	+ 260
„ Switzerland ...	1,100	1,100	—
„ United States ...	900	1,500	+ 600
„ Great Britain ...	600	200	− 400
Electric lamps—			
Total (thousands)	16,700	16,400	− 300
From Austria	1,700	1,500	− 200
„ Germany	5,700	4,800	− 900
„ Holland	7,800	8,600	+ 800
„ Switzerland ...	137	27	− 110
„ Hungary	1,040	1,200	+ 160
Insulated electric wire or cable, covered with rubber or textiles	1,500	1,700	+ 200
Ditto, armoured, including submarine cables ...	2,500	2,400	− 100
Electric lamps—			
Total (thousands)	16,700	16,400	− 300
From Austria	1,700	1,500	− 200
„ Germany	5,700	4,900	− 800
„ Holland	7,800	8,600	+ 800
„ Hungary	1,000	1,200	+ 200
Exports.			
†*Insulated electric wire or cable, covered with rubber or textiles*	5,100	5,300	+ 200
†*Ditto, armoured, including submarine cables* ...	22,000	35,000	+13,000
Electric generators and motors—			
Total	18,600	23,700	+ 5,100
To Belgium	500	900	+ 400
„ France	1,100	1,400	+ 300
„ Spain	900	1,300	+ 400
„ India	3,100	3,200	+ 100
„ Argentina	2,300	3,600	+ 1,300
„ Brazil	5,000	3,300	− 1,700
Static transformers	1,700	3,200	+ 1,500
Accumulators	2,000	2,200	+ 200
Magnetos	500	400	− 100
Electricity meters	70	95	+ 25
Telegraph and telephone apparatus	106	580	+ 474
Radio apparatus	370	800	+ 430
Insulators, porcelain, &c. ...	480	510	+ 30

† Principal destinations: Argentina, United States, Rumania, and Brazil in 1926, and Argentina, Peru, Poland, Cuba and United States in 1925.

Reviews.

Electric Power Stations. By L. W. W. MORROW, M.E. Pp. viii+326; figs. 177. London and New York, 1927: McGraw-Hill Publishing Co., Ltd. Price, 20s. net.

The publication of a volume on the subject of electric power stations is perhaps particularly appropriate after the passing of the Electricity (Supply) Act, 1926, and although the present work is based on American practice, there is naturally much of the subject matter that is common to this field of engineering on both sides of the Atlantic.

The author mentions that the United States stands in the front rank of the nations in point of material accomplishment and social well-being, and this position has been attained very largely through its great use of power. It will generally be admitted that the prosperity and commercial position of an industrial nation can be measured by its use of power *per capita* of the population, and the American figures are certainly striking in this respect, Chicago at present probably holding the world's record.

In a brief survey of notable developments in electricity supply, whilst great credit is undoubtedly due to Edison and other pioneers, it is a little disappointing to find no mention of British inventors and pioneers such as Hopkinson, Ferranti, Crompton and others, without whose work American progress would not have been possible. The statistics given in the opening chapter are of interest, and one notes that the record for annual output is held by the Niagara Falls Co. with over 3,161 million kWh, whilst the record for peak load is held by the Commonwealth Edison Co. with 809,000 kW. The figures are increasing steadily each year, and there seems to be as yet no "saturation" limit as regards the consumption of electricity.

The general considerations relating to the situation of stations in regard to area of supply and location of loads are briefly dealt with, whilst buildings and foundations and such matters as the heating and ventilation of the station are considered. Notes on the apportionment of the capital costs of the various sections are made, and sector cost diagrams for four stations are given on a percentage basis. The approximate investment costs of only two stations are given, and in a future edition the value of this chapter would be enhanced by the inclusion of additional cost data for typical plants.

The question of fuel supplies is of paramount importance in the large American stations, and the author gives a brief survey of current practice in regard to fuels, handling and storage, and ash disposal. Fuel purchase by specification is considered, and the sampling and analysis of coal as recommended by the American Society for the testing of materials. It is interesting to note that most plants in the States consider that from three to nine months' coal stock is essential, and the author is of opinion that both rail and water borne fuel supplies should be arranged for when siting the plant. Although pulverised fuel firing is considered, the author is careful not to express any decided preference for either stokers or powdered fuel installations.

An interesting chapter on steam generation and utilisation has been compiled by the author, and progress in increased pressures is noted, with references to both British and American papers on the subject. The various thermodynamic cycles, such as the Rankine regenerative and the Ferranti reheating cycles, are considered, whilst several pages of costs and data relating to the operation and maintenance of 136 American stations are given in the text.

The auxiliary supply and heat balance systems of many of the larger plants in the States are commented upon by the author, and diagrams of the lay-outs are given, but on the whole it must be allowed that British practice is simpler as regards design, even admitting the slightly lower thermodynamic efficiencies obtained. The tendency in the States is now to provide for unit auxiliary supplies with the ever-increasing size of generators, and shaft-end auxiliary generators appear to be coming into favour. Preheated air is considered in this chapter and data are given from the comparative trials at the Philadelphia Electric Co.'s stations, although British practice in this respect is probably ahead of that in the U.S.A. In Table XXII, relating to preheaters, the heating surface given should be square feet and not square inches as in the text.

Boiler room equipment and lay-out is briefly dealt with and the tendency to the adoption of the large boiler cum turbo-generator unit is noticeable in American practice, the boilers being housed in groups in the same building as the turbine and its auxiliaries. The important subject of steam pipework is hardly touched upon, and such points as flexibility and drainage are not dealt with. The value of remotely controlled valves is being steadily appreciated in the larger stations, both on the score of safety and as labour-saving devices.

Turbo-alternators and auxiliary plant are considered in Chapter VIII, and notes on typical specifications and contracts are included. The 208,000-kVA unit recently ordered by the State Line Co. of Chicago is said to be the largest generator ordered to date, and of course two- and three-cylinder designs are still necessary and growing in favour, whilst admitting of the utmost economy in design.

The electrical lay-out and equipment of large power stations is, as the author points out, a difficult matter, as the base load station of to-day may become the stand-by or the peak-load station of to-morrow because of changes in conditions in a short period of time, and the designer is faced with a considerable number of problems on the electrical side of the plant. The author, however, gives some useful notes on the electrical design and deals with items such as switchgear, busbars, alternator heating and cooling data, and the parallel operation of large units and automatic protective gear.

A final chapter is devoted to switchboards and the housing of switchgear, and details of phase grouping and isolation on the horizontal and vertical systems, whilst useful notes on instruments and metering have been included.

The author has been successful in collecting and classifying a considerable amount of data relating to the design and operation of American power houses, and has drawn freely upon his own knowledge, so that the book should prove valuable to engineers on both sides of the Atlantic who are interested in the design and lay-out of electrical power plants.

L.M.J.

Theory and Practice of Alternating Currents. By A. T. Dover. Pp. xv+539; figs. 303. London: Sir I. Pitman and Sons, Ltd. Price, 18s. net.

This is a well-thought-out book prepared and produced with great care. It will be found very useful by students who are attending lectures in electrical engineering, but it is also particularly well adapted for the use of students who are reading alone, since the treatment is very full (too full, perhaps, in some parts), and there is an abundant supply of worked and unworked examples. The scope of the book is by no means so wide as its title suggests, for it does not include the generation, transmission or utilisation of alternating currents, there is no reference to a.c. machines, and only a bare reference to the transformer. The first ten chapters and the sixteenth, covering 341 pages, are devoted to a very thorough treatment of single- and poly-phase circuits. One chapter of eighteen pages deals with the magnetisation of iron by alternating currents, and four chapters, covering 153 pages, contain descriptions of and theory relating to the types of instruments and methods of measurement employed in connection with alternating currents. The numerous diagrams are all particularly clear, and meticulous care has been taken with the notation. The second chapter is specially welcome. It deals clearly with all the usual methods of representing complex alternating quantities.

A great deal of space is devoted to the load diagram for various types of circuits, and a student who has worked conscientiously through this chapter will be in a very good position to tackle more advanced problems which demand similar methods. In the chapters on instruments good descriptions of up-to-date apparatus are given and sufficient theory is developed to enable their action, and the nature and origin of probable errors, to be understood. Oscillographs of various types, including electrostatic and thermionic instruments, receive a proper share of attention, and, in the chapter on measurements, the a.c. potentiometer and some forms of a.c. bridge are discussed. The chapter on "wave forms" gives an introduction to arithmetical methods of harmonic analysis. The standard of the book is such that it is suitable for students in the third year of a full-time course at a university or technical college.

Having acknowledged the excellence of the book, we may, perhaps, be allowed to deplore its relatively high price. Eighteen shillings is a large sum for a student to spend on a book covering a comparatively small part of his whole curriculum, for if he is called upon to spend at the same rate for the remainder of it he will be faced with an appalling bill for his books. Moreover, when he had bought them all he would find to his annoyance that he had paid several times over for much of the subject matter which would be common to several books. Surely it would be to the benefit of all concerned if publishers' editors paid a little more attention to this point. The book before us is not a bad example of this kind, but some of the matter in the chapters relating to inductance and capacity is quite general, and should occur in some other textbook on electricity which will be in the possession of a student who has reached the stage at which he can profit by Mr. Dover's book.

In some places the treatment might have been shortened, and space and cost thereby reduced; for instance, in the chapter on the calculation of polyphase circuits several cases are worked out, in full, from first principles, which are later attacked by a more general method. This very long chapter of nearly sixty pages might have gained in value by a little judicious pruning. If the price could be brought down to fifteen, or, still better, to twelve shillings, a real boon would be conferred on a large body of students.

There are a few printer's errors, and the author himself has made a small number of slips; thus, on p. 111 he says that the parallel capacity necessary to reduce the angle of lag in a given circuit from ϕ_1 to ϕ_2 is proportional to $\sin \phi_1 - \sin \phi_2$ instead of to $\tan \phi_1 - \tan \phi_2$, and on p. 210 he says that the cross section of the lines in a six-phase system transmitting a given amount of power at a given voltage depends on the method of connection of the transformers supplying the power. The statements made about "reactive power" reveal some rather confused thinking; many teachers will object to the use of the term "reactive power" instead of "reactive volt-amperes," for although EI sin ϕ does indeed indicate the maximum rate at which energy is transferred between its alternate storage in generator and in circuit, this quantity is so radically different from EI cos ϕ that the word "power" should not be associated with it. On p. 209 we are told that in a balanced polyphase circuit the stored energy is constant and there is no surging between generator and circuit as in a single-phase case, and the impression left on the reader is that there is a fundamental difference between the two cases, whereas the fact is that the interchange of energy between the various component circuits takes place *via* the generator, and the surging along the lines is the same in both cases. A small point which may jar upon some teachers is Mr. Dover's method of dealing with the resistance drop in a circuit. He says (p. 46), in relation to a circuit containing resistance and inductance, "The internal e.m.f.'s in the circuit are (1) the e.m.f. due to resistance ($=e_R = -Ri$) which has a phase difference of 180 deg. with respect to the current; (2) the e.m.f. of self-induction ($e_L = -L\,di/dt$) which has a phase difference of 90 deg., lagging. . . . The impressed e.m.f. (e) must balance the internal e.m.f.'s. Therefore $e = -(e_R + e_L) =$ &c." It is not usual to treat RI as a back e.m.f. in direct-current circuits, and many teachers would probably prefer to maintain a consistent attitude throughout.

In conclusion, we may say that although the number of books on this subject is already large, Mr. Dover's contribution is a welcome addition to them; it is thoroughly modern, and has many distinctive features of its own.

Elementary Heat and Heat Engines. By F. G. R. Wilkins, A.R.C.Sc., B.Sc., A.M.I.Mech.E. Pp. 312; 122 diagrams. London: Oxford University Press. Humphrey Milford, Publisher to the University. Price 7s. 6d. net.

Except in those countries where water power is available, the heat engine in some form or another represents the only method yet available for driving electrical generators. Hence the study of heat engines is a matter of great importance to the electrical engineer. But in order thoroughly to understand the principles underlying the operation of the various forms of heat engine used in commercial practice, a knowledge of physics is almost essential, particularly of that branch of physics which goes under the title of "Heat." In this little book, the author has endeavoured to give just so much of the pure science as is essential for a better comprehension of the practical problems governing the action of various forms of heat engine, and it must be admitted that he has performed his task well, within the limits imposed by what must be regarded as a very elementary treatment of his subject. The book, it may be noted, has been prepared primarily for students of the heat engine portion of the subject referred to as Engineering Science by the Board of Education, and we are particularly impressed with the wisdom of studying side by side the physical effects of heat, such as conduction, expansion, change of state, and so on, in conjunction with their influence on the practical problems of heat engine design and operation.

Some idea of the extent to which this combination of theory and practice is studied in this book will be gathered from a brief *résumé* of its contents. After a brief introductory chapter in which the author deals with the general problem of the conservation of energy and the efficiency of energy transformations, there follows a chapter on the nature, sources, and effects of heat. Three chapters are then devoted to the physical effects of heat, expansion, conduction, and change of state, after which we have a useful chapter on the properties of steam, in which steam tables and their uses are discussed. We cannot help thinking that in view of its importance in a more advanced study of the subject, the idea of entropy might have been introduced and treated in an elementary way in this part of the work. The final chapter of what may be regarded as the theoretical portion of the book deals with combustion and fuels. The remainder of the volume, representing about two-thirds of the whole, is devoted to a study of the various practical forms of heat engine, including the steam turbine and the internal combustion engine, and a chapter is given setting forth the historical development of the heat engine. There is also a chapter on boilers and boiler fittings. It is greatly to be regretted that in this part of the book the author falls into the very common error of treating at great length the moribund reciprocating steam engine, while treating in only the most cursory manner the steam turbine. In this age of electricity, nearly all generators are driven by steam turbines, and for small powers where once the steam reciprocating engine reigned supreme the electric motor or the small internal combustion engine is employed. And yet in this book we have four chapters devoted to the reciprocating steam engine, as compared with one each for the steam turbine and the internal combustion engine. To the electrical engineer and, indeed, to any engineer—except, perhaps, the locomotive engineer—such a proportion must appear to be hopelessly antiquated. Perhaps the author, while admitting the justice of our contention, will reply that he merely follows the syllabus laid down by the Board of Education, in which case, for the sake of our young engineering students, we suggest that representations should be made to the Board with a view to having the syllabus brought up to date.

It may be noted that a number of numerical exercises are appended to each chapter, the answers being given at the end of the book. These exercises are not all of a simple type, as the familiar formula $\eta = 1 - 1/r^{n-1}$ is discussed in the chapter on internal combustion engines, and yet in calculations on expansion of gases the essential adiabatic expansion pv^n=constant appears to be regarded as being too advanced for consideration. Other inconsistencies could be noted, as, for example, steam tables which go up to pressures of 500 lb. per sq. in. abs. and a table of specific heat of superheated steam which does not go higher than 200 lb. per sq. in. But even when all the limitations almost inseparable from an elementary treatment of what is undoubtedly a difficult subject are kept in mind, the fact remains that this book is one which can be cordially recommended not only to the student for whom it is primarily intended, but also to the power station engineer who has not had the advantages of a technical school training.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

Output Transformers.

It is desirable to feed many types of loud-speaker, and in some cases essential, through an output transformer as indicated in fig. 1. Those manufactured by MESSRS. FERRANTI, LTD., are similar in appearance and construction to their well-known audio-frequency transformers, their windings being likewise sectionalised in order to minimise the difference of potential between turns and self capacity. Ordinary and cathode-ray oscillographs indicate that the output wave-form of the transformer is as pure as that on the input side, whilst even when a plate current of 30 mA is flowing through the primary winding the output wave-form is claimed to remain undistorted. The measured amplification of a power valve, plus output transformer and loud-speaker, over frequencies of from 100 to 8,000 cycles is said to be only 7 per cent. less throughout the frequency scale than that obtainable with the speaker connected directly in the plate circuit of the valve; this difference, which is not an audible one, is due to the fact that the speaker has a slightly higher inductance when directly connected, owing to the d.c. flowing through its coils strengthening the magnetic flux through its poles and diaphragm. Ferranti output transformers weigh 2 lb. 8 oz.; their dimensions are 2¾ by 3 by 3¾ in., and they

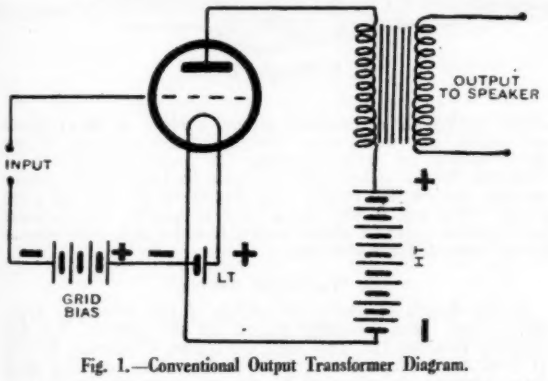


Fig. 1.—Conventional Output Transformer Diagram.

are obtainable in two ratios: type OP.2 (25 to 1 ratio) for operating coil-driven cone speakers, the low inductance and impedance of which render them unsuitable for direct connection to the plate of any single valve; and type OP.1 (1 to 1 ratio) for use with ordinary cone and diaphragm speakers, in which case the main object is the elimination of the d.c. plate current of the last valve from the speaker's windings and the latter's isolation from the high-voltage, with the following advantages:—The large current taken by power valves cannot damage the speaker windings, and its magnets cannot be damaged by a reversal of connections; signals will not be distorted by magnetic saturation of the speaker pole pieces, and the gap can be more finely adjusted because d.c. current does not pass round the windings; removal of the possibility of shock from the speaker terminals when an anode-battery eliminator is employed (either pole of which may be at a higher voltage relative to earth); and more volume is obtainable without overloading because of the ability to apply higher voltage to the plate of the power valve, which avoids the excessive voltage drop normally occurring in loud-speaker windings. An output transformer is invariably preferable to a choke filter since the latter limits the plate current passing through it, and the blocking condenser must be large if the lower notes are to be reproduced properly, the resultant lag caused by the condenser charging and discharging being apt to spoil music.

New 6-Volt Valves.

The new range of 6-volt valves of the MARCONIPHONE CO., LTD., and the GENERAL ELECTRIC CO., LTD., are claimed to be fitted with longer filaments than any valve of equivalent class. They therefore have a greater surface area for the emission of electrons, which reduces the internal resistance, or impedance, of the valve. The DEL.610 general purpose valve has a characteristic "slope" of 1.15 milliamperes per volt, an improvement of nearly 400 per cent. at one-seventh of the current consumption of the original R.5-V type. When used as a detector its high ratio of amplification factor to impedance (slope) assists sensitivity and smooth operation in circuits employing reaction; it is recommended as a short-wave detector valve in Reinartz circuits. It is suitable for use in low-frequency amplifier transformer- or choke-coupled circuits and as a high-frequency amplifier in the modern stabilised circuits. Its filament current is 0.1 amp., anode voltage 120, amplification factor 15, and impedance 13,000 ohms.

The DEH.610 resistance-capacity amplifier is also recommended as an anode-bend detector, its anode voltage being 150, amplification factor 40, and impedance 65,000 ohms.

The DEP.610 power valve has a "slope" of 1.55 milliamps. per volt, and an impedance of only 4,500 ohms, which avoids the necessity for the use of very large output-chokes, &c., with their inherent self capacity and consequent "muffling" of the treble notes. The low impedance is not obtained by sacrificing the amplification factor, which is retained at 7, the anode voltage being 100 V maximum.

Some "Goltone" Products.

Messrs. WARD & GOLDSTONE, LTD., have sent us a sample of a well-made aerial conductor of unusual pattern. It is composed of 49 wires, each individually black enamelled, which are stranded in groups of seven around a central seven wires; the whole is then braided over with yarn, and this outer cover is treated by the "Negrolac" process with an insulating composition to render it weatherproof. For indoor use, the "Enhausa" aerial consists of no less than 96 wires, there being three major strands, each having a braiding of multiple fine tinned-copper wire; the aerial is provided with a porcelain insulator at either end and a loop for the attachment of the down-lead. The company has also produced a special wire for back-of-panel connections; the conductor is rubber insulated and finally covered overall with fine aluminium foil, which is wound on in strip form, and serves for screening purposes. We have also received samples of a new pattern of "quickgrip" spring terminal attachment which will be appreciated by those who need to make and break connections quickly. The addition of a forked terminal contact spade renders the device useful for many purposes, and it is substantially made; the larger patterns, of 10- and 20-amp. capacity, are galvanised. As connectors of this description have hitherto been imported, it is satisfactory to know that an efficient British-made article is now obtainable at a competitive price.

The "Flatplate" Aerial.

MESSRS. A. H. HUNT, LTD., have sent us a sample aerial, which they now have ready for the coming season's market, that has been designed for the convenience of flat dwellers and others who are unable to erect the conventional type of P.O. aerial. Made of copper and locked on an ebonite rod, which may be clamped to a short pole as shown in fig. 2, it should give good results when a long vertical down-lead is employed; tuning is somewhat sharpened.

The "Quixo" Battery Tester.

It is not always realised that a battery test by means of an ordinary voltmeter may often be very misleading because such an instrument imposes no load on the battery. A device which has been placed on the market by the RUNBAKEN

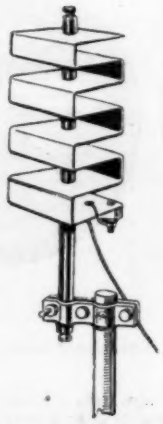


Fig. 2.—The Hunt "Flatplate" Aerial.

Fig. 3.—The "Quixo" Battery Tester.

MAGNETO CO. not only obviates this risk, but is also very easy to use, for a small electric lamp is attached to the base of the handle, as indicated in fig. 3, so as to illuminate the dial and facilitate the reading of the meter.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Potential Indicator.

A recent development of Messrs. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester, is a simple device for indicating whether a h.p. circuit is alive or not. The essential part of this device is a neon lamp, or lamps, in which a glow is produced by the capacity current from the cable, suitable bushings being provided.

Fig. 1 shows the arrangement; one terminal of each lamp is connected to a lightly insulated earth band of the corresponding phase bushing, the remaining lamp terminals being coupled together and earthed. The lamps are "short-circuited" to earth

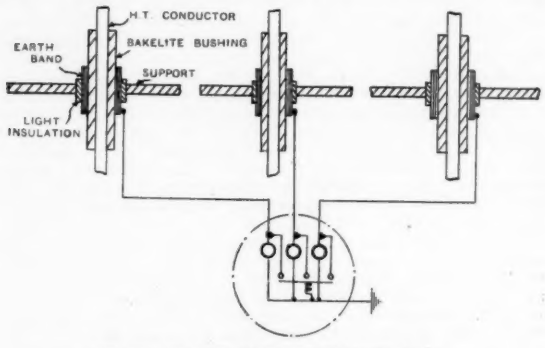


Fig. 1.—Potential Indicator Wiring Diagram.

by the switch before access can be obtained to them. Although a standard bushing may be employed, it is preferable to use a semi-condenser pattern. As the potential across the lamp under normal operation is only about 180 V, there is no necessity for special precautions regarding the insulation of the wiring to the lamp. Fig. 2 shows exterior and interior views of an indicator designed for 3-phase operation, being provided with three lamps. These are located in a common case, which is about the size of a standard 8-in. dial voltmeter case. The cover is furnished with three circular glass-fronted apertures so that the instrument can be read at a glance. It is also fitted with a hinged lid which, when released, operates a spring-actuated switch located inside the instrument, and connects the live side of the lamps (which are normally shunted by a small air gap) with the common earth terminal. The instrument can be supplied suitable for any

Fig. 2.—The Indicator Proper, Exterior and Interior.

a.c. system for pressures of from 200 V upwards. When supplied for any particular voltage it will operate over a very wide range, a standard 6,600-V equipment giving a clear indication at 300 volts. A single indicator can be permanently connected up to a large number of bushings, when it will indicate if any one of the bushings is alive, and will be undamaged if they are all alive. Under normal conditions there is no limit to the life of the lamps or to any other part of the equipment. The instrument is particularly adaptable to special conditions, and it can be used as a check for synchronism prior to switching in.

An Electric Chipping Hammer.

MESSRS. F. GILMAN (B.S.T.), LTD., Regent Street, Smethwick, have recently made an addition to their extensive range of boiler-scaling and rust-removing appliances, the "Skatoskalo" patent chipping hammer, fig. 3, which is designed for dealing with Lancashire-type boilers, and is interchangeable with the rotary heads supplied by the makers for these boilers. The apparatus is electrically driven through a flexible

Fig. 3.—Chipping Hammer.

shaft ending in a bevelled pinion driving a short shaft on which are two arms carrying hardened-steel rollers fitted loosely on their spindles. A centrifugal action is imparted to the rollers which results in blows on a striker bearing against the chisel. The flexible shaft runs at 2,800 r.p.m. This tool is very light, easy to handle, and requires one operator only; its shape enables it to be used with success in the most difficult positions.

A Watertight Switch.

A new design of watertight switch of the Admiralty type, fig. 4, has been recently placed on the market by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. It is of the "Magnet" one-way flush pattern, earthed with front wiring terminals, and has an extremely rapid make and break, the mechanism being robust and simple in construction. The case itself is of naval brass. The cover is secured to the case by means of four cheese-headed brass screws, and has the words "on" and "off" cast on. A rubber gasket is provided to make it watertight. The operating handle is of the pointer type, and works through a gland

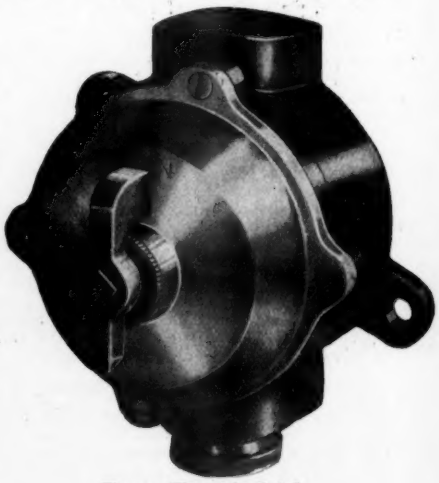


Fig. 4.—Watertight Switch.

in the lid. At the cable entry a packing gland with a rubber washer is provided, and is screwed into a boss on the case; the boss will take conduit direct if required. The exterior is painted battleship grey, and the switch has been designed primarily for marine work, but is suitable for use in many installations where the conditions demand switches of the watertight type. The capacity of the switch is 5 A, and the diameter of its base 4½ in.

A Norwegian Development.

Some particulars of the Morkfos-Solbergfos hydro-electric power station, the first part of the constructional programme of which has recently been completed, bringing its capacity up to 77,000 h.p.

THE recent addition of the seventh turbine generating set at the Morkfos-Solbergfos hydro-electric power station in Norway, which is jointly owned by the City of Oslo and the Norwegian Government, the latter holding one-third of the capital, brings the initial programme of the undertaking to a state of completion.

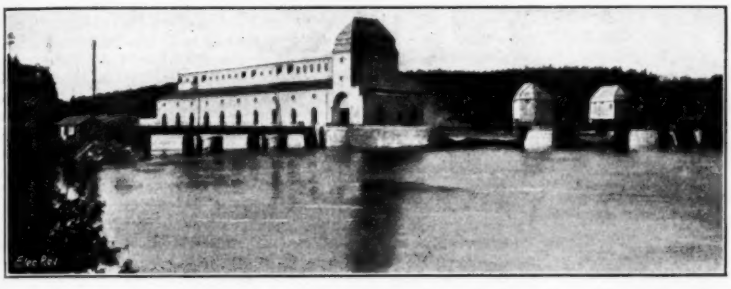


Fig. 1.—The 77,000-h.p. Hydro-electric Power Station.

The station, which utilises the water of the Glommen, one of the largest rivers in Norway, is situated 58 miles from the mouth of the river and 2¼ miles below the Oieren lake, which, with its area of 33½ sq. miles, constitutes an excellent regulating reservoir for the power station. In the winter the smallest stream flow to be reckoned with is 52,000 gal. per sec., while in spring, when the snow is melting rapidly, the flow may rise to 660,000 gal. The power is supplied by the three waterfalls of Wittemberg-Halsfredsfos, Solbergfos and Morkfos, representing a total head of 72 ft. in the winter and from 52 to 56 ft. in the summer. Once the full programme of construction is completed, the installation will be capable of developing 130,000 h.p.; the plant will then consist of thirteen 11,000-h.p. sets, one of these being a "stand-by." The hydraulic works have already been fully completed, but the power house itself, fig. 1, has so far only been built to accommodate ten sets, the building being 137 ft. wide and about 450 ft. long.

The main dam is of concrete and measures 370 ft. along the crest, 13 ft. wide at the top, 98 ft. at the base, and 160 ft. high from the lowest point to the crest. In order to regulate the flow and the height of the storage, provision has been made in the dam for three roller sluices, each 65 ft. long.

The general arrangement of the turbine plant is shown in fig. 2. Fig. 3 shows a section through one of the sets. The turbine is of the low-head Francis type with a specific speed of 365 r.p.m. It is capable of developing 11,000 h.p. when operating under a head of 69 ft. and at a speed of 150 r.p.m. The helical casing at the inlet of the turbine and the suction pipe are made of reinforced concrete, the suction pipe being lined with sheet-iron. The turbines were manufactured by Kvarner Brug and Myrens Verksted, two Norwegian firms, while the generators were supplied by the Oerlikon Company.

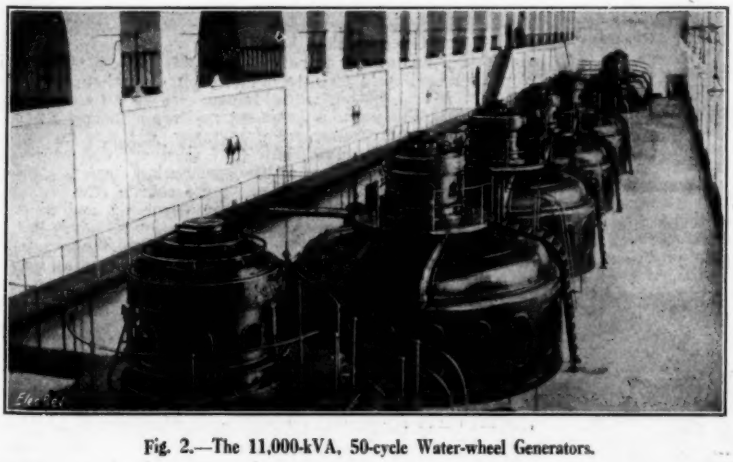


Fig. 2.—The 11,000-kVA, 50-cycle Water-wheel Generators.

The generators are each continuously rated for an output of from 10,000 to 11,000 kVA, 50 cycles, 10,000 to 11,000 V. Provision has only been made for three guide bearings; the lowest of these is on the turbine, and the two upper ones are fitted to the generator. The thrust bearing mounted on the top of the generator has to deal with the whole weight of the rotating parts of the whole set, which, with the thrust due to the water pressure, represents a total of 150 tons.

The stator is in four parts, each weighing 14 tons, and rests on a bed-plate having four projections to which the lower bearing support is secured. This support is so dimensioned that it can carry the 60-ton rotor, when the latter is lifted on hydraulic jacks for the purpose of dismantling the thrust bearing. The 60-ton rotor had to be made in several parts in order to keep the dimensions within the permissible limits for transport.

A pneumatic brake is arranged below the rotor between the latter and the lower bearing support, and can only be operated when the guide vanes are completely closed. It is mainly intended for bringing the set rapidly to a standstill in the event of a defect occurring.

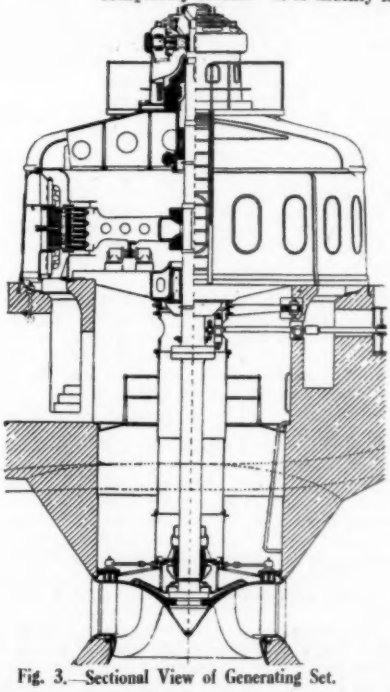


Fig. 3.—Sectional View of Generating Set.

The pressure regulation of the generator is ensured exclusively by varying the excitation of the exciter, a quick-acting regulator being used.

During a full-load test on one of the generators the load, pressure, and speed were kept as constant as possible for 8½ hours, and the maximum temperature rise obtained was 10 deg. C. below the guaranteed value of 60 deg. C.

The whole output of the station at the present time is taken by the City of Oslo, which has a winter load of 70,000 kW. The power is transmitted at 60,000 V by means of five three-phase lines over a distance of 25 miles, to the Toien sub-station in Oslo, from which it is distributed. Oslo is one of the few large cities in Europe where electricity is used on a very extensive scale for cooking and heating, a development which has been greatly favoured by the low rates available. Energy is supplied to householders at the rate of 180 kroners per kW (under £10) for the whole year, and can be used without restriction for lighting, cooking, and heating.

The Eaton Companies.

Investigation by Receiver.

THE first meetings of the creditors and shareholders of the Electricity Finance and Distribution Corporation, Ltd., were held on July 25th, at Carey Street, before Mr. H. E. Burgess, Senior Official Receiver. The compulsory winding up order was made on May 17th upon the petition of the executors of the late J. E. Passmore. The deceased gentleman had launched an action against the company in January, 1926, claiming damages for fraud and misrepresentation in respect of the sale to him of certain shares and debentures in the Southern Counties Electric Light and Power Supply, Ltd., and in March last the executors obtained judgment for £351 and costs, which had not yet been taxed. The chairman reported that his principal witness, Col. Edmund Eaton, was apparently unfit to attend, and until he could obtain the proper story from him he was in some difficulty. The other directors and officials merely did as they were told, and were unable to give any information of value. No proper minute book had been kept recording the transactions; someone used to prepare minutes of meetings which had not taken place, and send them round to the directors, who signed them. He did not know whether those persons would get into trouble for their neglect, but they certainly deserved to do so. This corporation was used as a promoting company and to take over the issues of shares and debentures of other concerns in which Col. Eaton and his associates were interested. It was promoted as a private company in April, 1923, with a capital of £2,000, by Col. Eaton, and the powers it took were to deal in shares and debentures of the Southern Counties Co. and other kindred concerns; to obtain control of their capital, and to promote further companies and offer their shares to the public. During the whole of its existence it had been under the control of Col. Eaton. The directors of the company had been Messrs. Wilfred Burton, Walter Thompson (resigned 1923), Charles Wm. Bower (resigned 1923), Allan McLean Eaton (deceased), Edward Newman, and Llewellyn J. Waring. Burton had not acted as a director since December, 1925. A director's qualification was the holding of £25 shares, but none had qualified, and as was the case in the other companies of the group, he was finding some difficulty in making the directors pay up. The directors' fees were fixed at £10 10s. per annum each, and the directors, with the exception of Burton, were employed by the corporation at small salaries. In addition, A. M. Eaton and R. G. Harley received special expenses when an issue of shares or debentures was made, such expenses amounting to about £1,000 and £300, respectively. Col. Eaton also drew special expenses to the amount of about £3,000, these expenses being in all cases in addition to travelling and out-of-pocket expenses, but no explanation had been obtained from Col. Eaton as to the consideration given for the payments to which he helped himself.

Mr. Colwill, who held a proxy for Col. Eaton, said that the corporation acted as issuing house for the Wareham Electric Supply Co., Ltd. A difficulty arose because the issuing house sold shares in that company for unissued capital, whereas they should have been for existing shares. When that fact was discovered, the corporation re-purchased for cancellation some debentures and a great number of shares of the Wareham Company. A fund had to be provided for that purpose, and it was largely provided by the Wareham Company and its associates.

The chairman said that the corporation handled very considerable sums, and if Col. Eaton wanted to make payments there were the means of doing so from the moneys passing through its hands. The only books of account he had received were two cash books, and they appeared to have come into existence only shortly before the making of the winding up order. The register of members was compiled about the same time from the annual return registered at the Registry of Joint Stock Companies instead of the return being compiled from the Register of Members. The whole thing was conceived in such a way as to prevent all inquiries being effectual. The corporation's business had consisted of the issue of prospectuses and offers for sale of shares and debentures of companies of which Col. Eaton, or one of his concerns, had obtained control. The corporation had also been used by Col. Eaton in obtaining control of certain of these companies. The following was a list of such concerns and the amounts actually received by the corporation in respect of them for issue expenses, office accommodation, and the provision of clerical staff, &c. :—

Wareham Electric Supply Co., Ltd.	£2,784
Chagford and Devon Electric Light Co., Ltd. ...	748
Warwickshire and South Midlands Electricity Supply Corporation, Ltd.	6,439
Cambrian Electricity Supply Corporation, Ltd.	*Nil*
Heathfield and Waldron Gas Light & Coke Co., Ltd.	45
Navenby and Wellingore Gas Light & Coke Co., Ltd.	754
Electric Light & Power Contracts Finance Corporation, Ltd.	1,400
Southern Counties Electric Light & Power Supply, Ltd.	£6,447
South Midlands & Berkshire Electric Light and Power Co., Ltd.	733
Woolulose Holdings & Investment Co., Ltd. ...	120

Those sums amounted to nearly £20,000, which the corporation had received as profits on the various transactions. The chairman next gave detailed particulars of the corporation's transactions with the Wareham Electric Supply Co., Ltd., which particulars appeared fully in the report of that company's liquidation meetings in our issue of July 8th (p. 60). He said that in April, 1923, Eaton offered to acquire the business of the Barford Electric Supply Co., Ltd., on the same basis as that of the Wareham Company. The shares were to be taken over at their face value, plus 2½ per cent., and the liabilities, including a bank overdraft, totalling £2,800, were to be discharged by Eaton or his nominee. In consideration for finding this £2,800, the corporation received from the Barford Company a debenture for £5,000, and for some reason that debenture was issued in the name of a nominee of Mrs. Eaton, who was supposed to have provided a part of the £2,800, although it was probably obtained from transactions in shares of other concerns. As soon as those debentures were acquired they were offered to another concern, which was created to take them over. This was merely another scheme for squeezing money out of the public by giving them something which sounded profitable but was a mere shell. In December, 1923, the Warwickshire and South Midlands Electricity Supply Corporation, Ltd., was promoted to take over the shares and debentures of the Barford Company, and Mr. Walter Thompson, the solicitor appointed to carry through the transfer, acted as trustee for certain shareholders and holders of £5,000 debentures in the Barford Company. An agreement was made by which the Warwickshire Company undertook to re-purchase the shares at a profit, paying 12s. 6d. for 10s. shares and 22s. 6d. for £1 shares, and par value for the debentures. It followed that the debentures which had cost the corporation under £3,000 were sold to the Warwickshire Company for £5,000. He would not be surprised if the Barford or the Warwickshire Companies some day came into those offices (Carey Street). Mr. Burgess said that in November, 1924, the Southern Counties Electric Light and Power Supply, Ltd., agreed to purchase from the corporation all sorts of rights and titles under certain agreements which had been entered into giving the corporation the right to call for options relating to the installation of an electric generating station in Sturminster; a piece of land at the same place; the acquisition of electrical plant and undertaking, together with a battery house and land at Battle; and the supply of electricity in bulk by the Chagford and Devon Electric Light Company. The consideration payable by the Southern Counties Company for those agreements was £2,800, and the corporation was to have the call for twelve months on 10,000 ordinary shares of that company at par. In March, 1925, the corporation agreed to purchase from Mr. G. Hughes, Spring Bank Mills, Heathfield, Sussex, for £1,990 and to re-sell the property to Col. Eaton at the same price, but although the corporation instructed him to pay the purchase price direct to Mr. Hughes, £1,332 thereof was found by the corporation. Col. Eaton subsequently contracted with the Southern Counties Company to sell a portion of the property to it for £2,600. The Southern Counties Company paid a considerable sum in cash, but never completed the purchase. Then there were many issues of shares of other companies, and in all cases it was found that the prospectuses and offers for sale were drafted by Col. Eaton, and it was only when final proofs were ready for the printers that they were sent round to the directors for approval, which was invariably given. The corporation issued the prospectuses on behalf of the companies concerned at a charge of from £6 to £8 per 1,000, exclusive of postage and printing charges. The prospectuses were dispatched to persons who were shareholders in other electrical, gas, water, &c., undertakings. The chairman further stated that he held a list of receipts by the corporation amounting to between £35,000 and £40,000, but it would be useless to go into details regarding them until he got hold of Col. Eaton and obtained a complete story. The same remark applied to a list of expenditure of nearly £49,000.

One of the last things the corporation did was to create an issue of £5,000 6 per cent. first mortgage debentures as a first and fixed charge on all the corporation's assets. There were no assets at the time to make the charge effective, and the bonds were apparently issued to cover up and smooth over certain accounts between the corporation and Col. Eaton, because £3,500 of the issue was given to him and the remainder to other directors for services rendered. In one case a director (Mr. Harley) had agreed to waive any claim under the bond, but seeing that the only property now possessed by the corporation appeared to be "office furniture, £30," the validity of the debentures was quite unimportant. No statement of affairs had yet been lodged under the liquidation, but the liabilities consisted of the before-mentioned debentures (£4,500), the validity of which he was not prepared to admit; unsecured creditors, £197; and various claims for damages sustained by persons being induced to take up shares or debentures in the corporation's associated companies.

In the absence of any resolution, the liquidation was left in the hands of the Official Receiver.

The Shanghai Electricity Undertaking.

Report for 1926.

WE have received from Mr. T. H. U. Aldridge, engineer-in-chief and manager of the Shanghai Municipal Electricity Department, a copy of his report for the year ended December 31st, 1926. This shows that the total sales of electricity for all purposes were 408,245,810 kWh, as compared with 294,343,905 kWh in 1925. Owing to the three months' strike in the latter year, however, the comparison is not a true one. In 1924 the sales amounted to 307,307,401 kWh, and thus in the two years the increase has been 32.8 per cent. Of the total the sales for power and traction accounted for 364,085,143 kWh. The plant capacity remained at 121,000 kW, but extensions are in hand comprising an additional 20,000-kW turbo-generator, three 180,000-lb. per hour boilers, main switchgear, &c. The new plant is expected to be in commission in the first half of next year. The maximum 30-minute load on the station was 89,600 kW, and the load factor improved from 53.06 to 61.79 per cent. As usual, this extraordinarily high figure is contrasted with the load factors of the largest British undertakings. Manchester was the nearest with 32.46 per cent., and it is interesting to note that in this case, while the maximum load was 136,110 kW, the sales were 300,440,765 kWh—about three-quarters of the Shanghai output. The number of consumers supplied rose from 38,932 to 43,378; the new connections during the year amounted to 20,484 kW, as against 12,173 kW in 1925.

The thermal efficiency of the Riverside power station improved slightly—from 17.43 to 17.89 per cent., and the B.Th.u.'s per kWh generated fell from 19,593 to 19,108. All of the three boiler houses showed improved efficiency; No. 1 boiler house went from 65.5 to 71.6 per cent. and the overall efficiency from 77.0 to 78.6 per cent. It is expected that the investment in air preheaters will prove to be a profitable one. A total of 45.47 miles of cables were laid during 1926, and at the end of the year the Department had 390 miles of cable in service in addition to overhead lines. There were 152 sub-stations and 52 pole transformers, and these, together with other distribution transformers, had a total capacity of 290,371 kVA.

At December 31st there were 6,667 motors, aggregating 130,572 h.p., connected to the mains, showing a net increase of 813 (13,922 h.p.) during the year. This is regarded as very satisfactory, and indicates that industrialists are inclined, or even anxious, to erect mills and factories within the area served by the Department. It is considered probable that with more settled conditions new industries will be launched, and projected extensions will be carried out.

The heating and cooking load increased in all sections, the greatest rise being shown by hired radiators, which numbered 5,130 (14,945 kW) as compared with 3,428 (9,378 kW) at the end of 1925. The whole of the load amounted to 19,348 kW, representing 7,238 appliances; this was an increase of 5,895 kW (1,808 appliances). The Department hires out 3-kW radiators at the very modest rental of 2 taels (5s.) per annum. The Department is confident that the use of electricity for cooking will within a few years form an important part of its business. The field of domestic supply is a vast one, and the achieved success of the heating business lends encouragement to the opinion that before long an increasing and profitable demand will arise for electric cooking.

For the reasons stated above, the financial results which follow are compared with 1924, and the currency is converted to sterling at the rate of 8 taels to the £. The total revenue amounted to £1,256,403, as compared with £1,153,378 in 1924, and the production costs (including depreciation) to £763,960, against £757,836, leaving a gross profit of £492,443 (£395,542). The revenue per kWh fell from 0.901d. to 0.739d., and the production costs from 0.592d. to 0.449d. After charging interest and other expenses there remained a net profit of £275,686, as compared with £183,020. To this was added £3,458 brought forward, and the total amount (£279,144) was distributed as follows: To general municipal funds, £150,000; to general reserve, £75,000; to special reserve for writing off capitalised interest, £50,023; carried forward, £4,121. In the last three years £412,500 has been handed over to the general municipal funds. The general reserve fund stood at £371,924 at the close of the year. The capital expenditure during the year totalled £229,917, principally on mains and transformers, and the net total capital expenditure at December 31st was approximately £4,000,000.

Electric Baking in Germany.

In connection with the German Bakery Exhibition which was held in Essen from July 16th to 31st, the "Germania" Central Union of German Bakery Guilds, to which most of the bakers in Germany belong, issued a statement which shows that it now has a membership of 86,777 bakers; of these, 47,945 own machine-equipped establishments, and no fewer than 44,483 use electricity for the operation of the machines.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The Economics of Wiring.

I read with interest the first portion of the article on "The Economics of Wiring," by H. R. Taunton, which appeared in your issue of July 22nd. Mr. Taunton compares electric wiring practice in the United States and in England, and deduces from the fact that the Association of Electragists International" is introducing an "All-Metal" programme that heavy-gauge screwed-conduit work is practically unknown in America, and that "knob and tube" work is the standard.

I am afraid that Mr. Taunton can have very little first-hand knowledge of the systems of wiring which obtain in America. Judging from my experience, up to 1914, the standard of wiring in the Far West is very much ahead of anything I have seen here, and this is for a standard voltage of 110 V for lighting as against our usual voltages of 230 and 250 V. The following is a brief description of the systems of wiring which usually hold in a western city:—

The city is divided into three fire limits, A, B and C, and different systems of wiring hold for the different limits. In district A, the centre of the city, comprising the business premises and main streets, heavy-gauge screwed-conduit work is the only system allowed. No flexible wire of any kind is permitted in this district; nothing but screwed piping in every part, inclusive of shop windows. Assuming that a building has to be wired in district A, the following system is carried out:—First, the pipe work is done, the piping being of the heavy screwed variety, lacquered inside, and each length bearing the stamp of the National Underwriters' Laboratory. When the piping work is finished (a complete earth metallic bonded system throughout in conjunction with metallic fuse boxes to which the pipes are clamped), the work is inspected, and, if up to standard, passed. If passed, a coloured card is placed on the outside door of the premises by the wiring inspector.

If the firm which is doing the lathing in the building starts covering over the pipes before this card is posted, a very heavy fine is imposed. When the lathing is finished, the plasterers complete their work, and, following on this, when the plaster is completely dried, the electrical contractors are advised when the wiring may be put in. No joints are allowed. Following on this, the fittings are erected, and each fitting must be stamped with a registered number from the National Underwriters' Laboratory, assuring that the whole system is up to a definite standard.

In district B, which is composed of the semi-business part of the town, surface-cleat wiring is adopted. Every fitting used in this work is registered and stamped. Where the wires go through walls, special asbestos woven tubes are used, called "loom" in the United States.

In the residential quarters, or district C, nothing but "knob and tube" work is employed. The tubes and knobs are standardised, as is the wiring, and very strict regulations hold as to the placing of the knobs and tubes and the work done. Again, all fittings are registered, which fact calls for a very high class of work.

I have worked on many jobs in the West in the past and I have been struck with their high standard. Where overhead work is carried out, the same precautions hold. All the fittings are registered, including the overhead equipment, and even the workmen's tools.

I noticed in the papers last week that a linesman was killed in London through using a safety belt which proved defective. It is almost a certainty that this belt was not a standard belt, and from my knowledge of overhead-line safety belts in the United States, such an accident would be almost impossible there.

I do not wish to discourage Mr. Taunton in his articles. If he had first-hand knowledge of the work and standards attained in the West in the past, I do not think he would draw the deductions he has drawn. When we get our work standardised here, as it is in America, then, and only then, will we be able to compare our work with theirs. Mr. Taunton probably knows as well as I do that a great deal of the contract work done in this country is carried out with cheap unregistered fittings, which, apparently, have to pass no tests. I look forward to Mr. Taunton's concluding article, which should be interesting. It does not always do, however, to assume, because one has had no experience of work in other countries, that the work there is of a lower standard than that carried out here. The average contract work in this country, much of which, of course, was carried out a good many years ago, is in all conscience bad enough without our endeavouring to make favourable comparisons with the work done elsewhere.

The rules drawn up by the I.E.E. should have been drawn up long ago, and the people of this country should be educated to learn that if lasting work is to be carried out in electrical installations it can only be done by some such standardisation as I have indicated above. How often do we go into premises where one sees magnificent cast-iron, totally-enclosed switch and fuse boxes with unprotected cables and wires emanating from them and lying loosely crossed outside? By all means

let electric wiring be carried out as cheaply as possible in this country, but only by means of rigid standardisation and careful inspection.

A. G. Harvey, A.M.I.E.E.

Greenock, *July 25th*, 1927.

[A copy of Mr. Harvey's letter was sent to the author, whose reply follows.—Eds. Elec. Rev.]

I have certainly not had Mr. Harvey's interesting personal experience of American wiring methods, and all I know about them is what I have read and what I have heard. My article, however, was based on neither, but on an official publication of the American Electragists, and the statements which Mr. Harvey criticises are fair deductions from its text.

The whole pamphlet is essentially a defence of the Electragists' "All-Metal" programme, and a plea for its general use, which would have no meaning if heavy-gauge screwed-conduit work were the common standard he suggests. Moreover, conduit is barely mentioned in the argument which, throughout, cites "Armoured Cable" as the standard not yet attained—which satisfies the "All-Metal" programme of the Electragists. The obvious and only possible deduction is that heavy-gauge conduit is only used by them in exceptional conditions, and even the more modest standard of armoured cable is so far from being generally adopted that they have yet to convince the supply companies and the public of its desirability.

Possibly Mr. Harvey's practice lay in one of the cities or towns which are quoted in the pamphlet as shining examples of those which have adopted the "All-Metal" slogan: a few, the original programme of "rigid" conduit, but the majority, its modified form represented by armoured cable. I have not the pamphlet in front of me, but, from memory, 66 towns were so quoted; from which it is not too rash a deduction that there are 666 which have not adopted it.

Mr. Harvey's happy experience in the Far West has perhaps led him to mistake the particular for the general—I make the suggestion with all diffidence, but relying on the authoritative statements of the American Electragists themselves, just as his experience of shoddy work in this country, admittedly all too common, has led him to imply that our standard is something less than that which he claims for America. Departures from a standard, however many, are not proof that it does not exist; and I am sure every reputable firm of contractors will support my general contention that heavy-gauge screwed conduit is *the* recognised standard in this country for all but domestic work, and is not to be beaten by that of any country in the world, even the United States.

It does not follow—although there is to-day a deplorable tendency to assume it—that, because Americans are better debt-collectors than we are, we must accept them as our masters in every sphere of human activity, from golf to electrical installation work!

H. R. Taunton.

London, *July 29th*, 1927.

Inconsistent Charges for Domestic Electric Service.

When the various charges for electricity and for the hire of electric cookers, &c., are compared, it is found that the same enthusiastic advocates of the use of electricity for domestic purposes who declare that a two-part tariff is essential for this class of supply, in order that the charge to the consumer shall be as low as possible consistent with the cost of providing the supply, hire out cookers, &c., at charges which are admittedly insufficient to cover the interest, depreciation, and maintenance charges on these appliances, not to mention the other costs incidental to the working of a hiring scheme, and hope that the balance of the hiring costs will be met by the profit on the additional kWh sold.

It is generally recognised, of course, that the charge for electricity should be divided into a standing charge and a running charge, if a reasonably equitable method of doing this can be devised, and the only serious difficulty in devising such a method is in finding a satisfactory basis for arriving at the standing charge for each consumer. Unfortunately all the existing two-part systems, which base their standing charges on rateable value, floor space, &c., are defective because the basis on which the fixed charge is assessed is not even approximately proportional to the standing costs incurred by the supply authority on account of a considerable proportion of its consumers, and when an opportunity occurs of making a really equitable fixed charge, by including in the hire of the cooker the full capital and maintenance charges, in addition to a proportion of the standing charges incurred by the supply authority on account of the demand made by the cooker, one would expect two-part tariff advocates to make full use of it.

To adopt a two-part tariff with a standing charge fixed on a more or less haphazard basis for the supply of electricity, and then add a part of what is obviously an equitable standing charge on the cooker to the charge per kWh, appears to be a peculiarly inconsistent system of charging.

Presumably the reason for not including all the costs in the hire charge is that, if this were done, the hire charge would be too high to be attractive; but unless the domestic supply is to be given at less than cost, the domestic consumers as a whole have to pay the total cost of their electric service, either in the hire charges, or in the charge per kWh, so that with a comprehensive hire charge and a low charge per kWh, those consumers who use their cookers most freely will pay less for their electric service than if the hire charge were lower and the kWh charge were higher; surely the total cost per annum is the cost that matters most to the consumer.

A method which undercharges those consumers who use their cookers occasionally, at the expense of those who use them regularly, can hardly be sound. The objection may be raised that if a small standing charge per kilowatt of cooker loading were added to an adequate hire charge, those consumers who purchase their own cookers would avoid this standing charge; but the fact should not be overlooked that such consumers would usually pay retail prices for their cookers, whereas the hire charges are based on trade prices. In any case, this objection could not be raised to the hire charges being sufficient to cover all the costs of the hiring scheme.

If there is a satisfactory reason for this apparent inconsistency, other than the doubtful expediency of making the hire charge appear, at first, to be more attractive, it would no doubt be very interesting to many of your readers, as well as to the subscriber, to have it explained.

Puzzled.

July 25th, 1927.

The Position at Croydon.

I regret very much to notice the letter from Mr. Cramb that appears in your current issue concerning "The Position at Croydon."

It would be much better to allow this unfortunate episode to close without further debate, but in simple justice to my Association I feel called upon to declare:—

(1) Following a debate at a meeting of the Committee set up to agree Clause 48 of the Electricity (Supply) Bill—as it then was—the late President of this Association (Mr. H. J. Miles) and the general secretary (Mr. L. C. Penwill) attended a meeting at Croydon between Mr. Cramb and local electrical contractors and came away fully under the impression that the misunderstanding occasioned by the action of the Croydon Chamber of Commerce in connection with the original Bill promoted by the Croydon Corporation had been cleared up. The defeat of the Electricity Committee's dual proposal (Assisted Wiring and Hire Purchase) came as a complete surprise to Mr. Miles, Mr. Penwill, and to the E.C.A. branch in Croydon.

(2) The local newspaper report quoted by Mr. Cramb concerning the Croydon Chamber of Commerce is inaccurate. The letter of thanks was not received from the Secretary of the Electrical Contractors' Association (Mr. Penwill), or the Secretary of the Croydon branch of the E.C.A. (Mr. F. Pritchard). The letter in question represented the independent action of one local contractor.

May I remind you of the essential facts contained in the original statement issued by my Association:—

(*a*) If local contractors had known that the assisted-wiring scheme was to come before the Corporation they would have taken all possible steps to secure the passage of the proposal through the Council.

(*b*) If local contractors had known that the hire-purchase of apparatus scheme had been added, they would have protested against its inclusion in view of Mr. Cramb's assurance.

(*c*) Following such a protest, however, they would have made every endeavour to agree to a mutually equitable hire-purchase scheme and to secure its unopposed passage through the Council.

Finally, may I plead for the true spirit of Clause 48 of the Electricity (Supply) Act to be applied to the case? Is it too much to ask for both sides to get together fairly and squarely and to work together for the common good?

William A. Shaw,
President, The Electrical Contractors' Association (Incorp.).

London, *July 29th*, 1927.

Rural Electric Lines.

I hope you will allow me to challenge a few of the statements made by Mr. R. Borlase Matthews in your issue of July 15th. He says that . . . . "the overhead line is but the forerunner of the cable," and calls this an "idea." If an overhead line costs, say, £400 per mile, why take it down and lose what has been spent, and start again with something costing twice as much?

If we knew just which routes would be really well loaded in five or ten years and those which would not, we might duplicate the former cables straight away, and would probably wait for new regulations before thinking of doing the latter. Mr. Matthews has a poor opinion of British line-construction engineers if he thinks they are better underground! Speaking seriously, the real cause of his poor opinion is that engineers in this country are allowed their own way when cable laying, and succeed, but when erecting overhead lines the same engineers must follow the detailed directions of the Committee which drafted the last regulations; the result (which always follows restriction and red tape) is resentment, followed by lack of initiative.

Mr. Matthews says that we appointed that Committee. He is in error! The Committee was, I believe, appointed by the Council of the I.E.E., not by those who, as a body, knew anything about overhead work, and certainly not by those

who had the technical responsibility for rural lines. I do not know if Mr. Matthews was on that Committee, but he is on most of them, and must take his share of the responsibility.

Mr. W. A. Turnbull, in your issue of July 22nd, suggests complying with the "spirit of the regulations rather than the letter." This is the first I have heard of such a thing being allowed. We recently had a line design referred back because, if the ground were flat (which it is not), the clearance under blizzard conditions, or at 120 deg. F., would, according to calculation, be 19.26 feet instead of 20 feet. It would have cost many pounds to obtain that extra and unwanted 9 inches of clearance to comply with the "letter." Only those who have to work with standard pole sizes know what a difference a few inches make under certain conditions.

Mr. Turnbull's galvanised steel-wire line would fit in with Mr. Matthews's idea of a short-lived line in some districts. We have yet to see galvanised-steel wire which will not rust. With regard to the stated saving of 50 per cent. by using steel, even if correct, it is hedged in by some interesting limitations: (1) A short line (only 3 miles); (2) an allowance of 5 per cent. for drop; and (3) a very high line voltage (11,000) for country work. If we add the transformer drop, say, 3 per cent., and allow a generator variation of 3 per cent., we have 11 per cent. In many cases there will be another 3 or 4 per cent. on a local low-pressure system, and perhaps 3 per cent. on a main line, so we get a possible 18 per cent. drop, *i.e.*, 10 per cent. more than the regulations allow. It is clear that this method would fail at 6,600 volts. The line drop alone would be 15 per cent. on the same loading, or the capital cost would be much nearer that of copper. Notwithstanding this, Mr. Turnbull deserves our thanks for doing this work with steel. We need people who "do noble things, not dream them all day long."

Mr. Turnbull's village kiosk seems unnecessary, and so are the 11,000-volt tails, which I think will have a short life. In Mid-Cheshire we lift the transformer up a few feet and save the tails—then we provide an iron-clad switch-fuse for the low-pressure mains, whether overhead or underground, and put a "split chestnut" fence around the outfit.

The "Aylesbury" pole is certainly "eyeable," but if the wires are left loose in the insulator tubes there must be strain insulators on every third or fourth pole, and there will be risk of abrasion of the wire due to relative motion between the line and the insulator in a gusty wind. However, we have again what we need—a "try out" instead of a "talk out." I wish Mr. Turnbull every success.

W. Fennell.

Northwich, *July 26th*, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

33,002. "Electric signalling systems." Schneider et Cie. January 8th, 1925. (245,761.)

1926.

318. "Electrolytic process and apparatus." H. C. Harrison (deceased). May 21st, 1925. (252,320.)

8,784. "Telephone systems." Standard Telephones & Cables, Ltd., and A. J. Chanter. March 31st, 1926. (273,786.)

8,890. "Galvanic cells." A. Heil. April 1st, 1925. (250,266.)

8,994. "Device for smoothing electrical currents and reducing their voltage." F. Thornton, Ltd., and W. H. Thornton. April 6th, 1926. (273,798.)

9,092. "Single or multiple pole switch with interlocking device for lamp-holders, adaptors, plugs, couplings, and the like." J. W. Wyatt, J. Wilson, and J. K. W. Manufacturing Co., Ltd. April 6th, 1926. (273,801.)

9,333. "Electric regulators." British Thomson-Houston Co., Ltd. April 14th, 1925. (250,932.)

9,367. "Wireless calling-up apparatus and wireless control apparatus." D. A. Stevenson. April 9th, 1926. (273,811.)

9,377. "Telephone receivers." J. W. Dungey and A. E. Drown. April 9th, 1926. (Cognate application 14,324/26.) (273,812.)

9,427. "System for the emission of sustained waves, or variable frequencies in electric guide cables or lines." Soc. Industrielle des Procedes W. A. Loth. April 15th, 1925. (250,933.)

9,477. "Method of and means for amplifying selected alternating potentials." O. J. Lodge, E. E. Robinson, and M. M. Melinsky. April 10th, 1926. (Cognate application 26,238/26.) (273,817.)

9,601. "Acoustic apparatus." British Thomson-Houston Co., Ltd., A. P. Young, and J. H. Butcher. April 12th, 1926. (273,825.)

9,611. "Telephone transmission systems." Standard Telephones & Cables, Ltd., and L. T. Hinton. April 12th, 1926. (273,826.)

9,612. "Terminal sets for use in telephone systems." Standard Telephones and Cables, Ltd., and C. P. Smith. April 12th, 1926. (273,827.)

9,738. "Loud speakers." Hopkins Corporation. February 11th, 1926. (265,908.)

9,813. "Electrically-illuminated signs." R. S. Woods. April 14th, 1926. (273,834.)

9,870. "Electrically actuated surfacing, smoothing, or polishing and like machines." Cyklop Akt. Ges. and G. Staehle. April 14th, 1926. (273,836.)

9,886. "Electric cells." J. W. Carpenter, E. S. Bacon, and Edison Swan Electric Co. April 14th, 1926. (273,837.)

10,046. "Process for electro-plating with chromium." Chromium Products Corporation. September 10th, 1925. (258,219.)

10,421. "Electric drives." F. L. Wachtler. April 20th, 1926. (273,847.)

11,070. "Automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. April 27th, 1926. (273,852.)

13,697. "Electric selectors." N. Lea and Radio Communication Co., Ltd. May 25th, 1926. (273,862.)

13,431. "Tuning apparatus for use in wireless receiving instruments." Ormsby & Co., Ltd., and A. Barringer. May 27th, 1926. (273,867.)

13,956. "Electric switches." C. W. Denny. June 2nd, 1926. (273,871.)

14,048. "Starting, lighting and ignition circuits for use with internal-combustion engines." Sunbeam Motor Car Co., Ltd., L. Coatalen, and J. S. Irving. June 3rd, 1926. (273,872.)

14,424. "Electric controllers." Electrical Apparatus Co., Ltd., and R. H. Barbour. June 8th, 1926. (273,874.)

14,490. "Electric connectors." G. H. Collins and H. F. Collins. June 9th, 1926. (273,876.)

14,563. "Inductance coils for use in radio apparatus." Igranic Electric Co., Ltd., and W. K. Alford. June 9th, 1926. (273,880.)

17,108. "Ignition apparatus for internal-combustion engines." H. L. Duncan. July 8th, 1926 (273,898.)

17,462. "Electric heating element." R. K. Hearn. July 12th, 1926. (273,900.)

17,466. "Self-driving device for generating electricity." P. Molloy. July 13th, 1926. (Cognate application 823/27.) (273,901.)

18,238. "Ignition magnets for internal-combustion engines." M. M. Cardellino. July 21st, 1926. (Patent of addition not granted.) (273,908.)

18,764. "Device for improving the temperature error in electricity meters." Landis & Gyr Soc. Anon. October 30th, 1925. (260,551.)

20,313. "Oil-cooling installation for electrical apparatus." Maschinenfabrik Oerlikon. September 25th, 1925. (258,848.)

20,315. "Kerr cells and control means therefor." Telefunken Ges. fur Drahtlose Telegraphie. August 18th, 1925. (257,268.)

21,114. "Telephones." J. W. Tunstall. August 27th, 1926. (273,924.)

21,222. "Apparatus for wireless signalling." A. J. Stevens & Co. (1914), Ltd., and H. C. Willson. August 28th, 1926. (273,925.)

21,223. "Variable electrical condensers." A. J. Stevens & Co. (1914), Ltd., and H. C. Willson. August 28th, 1926. (273,926.)

21,797. "Method of and apparatus for transmitting optical images." E. Belin. September 29th, 1925. (259,192.)

24,968. "Electrically-heated irons." E. C. R. Marks (Aktieselskabet de Norske Saltverker). October 7th, 1926. (273,939.)

25,879. "Electric switches." October 16th, 1926. E. Schattner. (273,941.)

26,453. "Oil-break electric switches." L. Magrini. February 16th, 1926. (266,290.)

27,312. "Signalling cables." Siemens-Schuckertwerke Ges. November 2nd, 1925. (260,626.)

27,583. "Protective systems for electric circuits." British Thomson-Houston Co., Ltd. November 3rd, 1925. (260,996.)

27,584. "Methods of electrically testing insulating layers." International General Electric Co. Inc. November 3rd, 1925. (260,997.)

28,441. "Dirigible guide-lights for automobiles." W. V. Van Etten. November 11th, 1926. (273,949.)

29,536. "Switches controlled by light." F. Trinchero. November 22nd, 1926. (273,952.)

30,353. "Supports or stands and controls for electric irons." C. L. Moyer. November 30th, 1925. (262,156.)

30,680. "Electric bright-annealing furnaces." Siemens-Schuckertwerke Ges. December 5th, 1925. (262,463.)

31,898. "Electric protective devices for the discharge of high potentials." British Thomson-Houston Co., Ltd. December 19th, 1925. (263,170.)

32,089. "Electrical control gear." J. E. Salthouse. December 18th, 1926. (273,966.)

33,056. "Electric synchronising apparatus." British Thomson-Houston Co., Ltd. December 31st, 1925. (263,869.)

1927.

649. "Manufacture of thermionic valves and like discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 12th, 1926. (273,970.)

1,737. "Electrode operation in electric arc furnaces." International General Electric Co. Inc. January 20th, 1926. (Addition to 259,615.) (264,851.)

1,944. "Current-coupling devices for electrically-operated dust-suction apparatus." Inventia Patent-Verwertungs-Ges. March 1st, 1926. (266,687.)

2,525. "System of and means for supplying electric power to railless vehicles." C. Capitelli. March 29th, 1926. (268,297.)

2,923. "High-frequency signalling." Telefunken Ges. fur Drahtlose Telegraphie. February 2nd, 1926. (265,585.)

3,237. "Adjusting mechanism for variable electric tuning devices." British Thomson-Houston Co., Ltd. February 4th, 1926. (265,608.)

3,325. "Radio-receivers employing four electrode valves." Soc. Dite la Radio-Industrie and Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. February 22nd, 1926. (266,325.)

3,458. "Electric knife blade switch." A. Negle. February 7th, 1927. (273,985.)

3,892. "Dynamo-electric machines for electric welding and like purposes." F. Creedy. April 16th, 1926. (Cognate applications 19,767/26 and 3,891/27, a divided application on 15,222/26. Patent of addition not granted. Divided application on 9994/26.) (273,987.)

4,223. "Electric distant control device." E. Granat and Compagnie des Forges et Acieries de la Marine et d'Homecourt. March 3rd, 1926. (267,100.)

4,832. "Basing machines for electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. February 19th, 1926. (266,380.)

5,474. "Thermionic amplifiers." Marconi's Wireless Telegraph Co., Ltd. February 26th, 1926. (266,749.)

7,313. "Electric circuit makers and interrupters." British Thomson-Houston Co., Ltd. March 26th, 1926. (268,329.)

7,955. "Electric pocket, cycle, and other lamps." F. Eckhardy and M. Hohnekamp. September 18th, 1926. (274,002.)

11,162. "Electric induction furnaces." Electric Furnace Co., Ltd. (E. F. Northrup). April 26th, 1927. (274,007.)

11,163. "Electric induction furnaces." Electric Furnace Co., Ltd. (E. F. Northrup). April 26th, 1927. (274,008.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from July 27th:—

Parmeko. No. 481,275. Class 6. Electrical machinery and parts thereof. No. 481,276. Class 8. Radio-telephonic sets and component parts thereof.—Partridge & Mee, Ltd., 12, Belvoir Street, Leicester.

Croomsite. No. 481,274. Class 8. Electric cables.—Greenwich Cable Works, Ltd.

Blue Boy. No. 481,576. Class 18. Stoves for use with oil, gas or electricity.—Falk, Stadelmann & Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARGOED (Merthyr Tydfil).—Central hall (£15,000), for the Wesleyan trustees; secretary

BARNSLEY.—Development, Burton Grange Housing Estate; borough engineer.

BASINGSTOKE.—Extensions and equipment, Park Prewett Mental Hospital; Hampshire C.C.

BATH.—Isolation hospital, for the T.C.; borough engineer. Sunday schools (£3,818), for Twerton Baptist Church; F. J. Amery & Sons, builders.

BEDWAS.—Housing scheme (20), for the U.D.C.; Idris Leyshon, architect.

BIRMINGHAM.—Extensions, Coleshill Hall and homes on estate; city engineer. Branch bank, Heybarn housing estate; city engineer.

BLIDWORTH (Mansfield).—Primitive Methodist Church; trustees, Mansfield Primitive Methodist Circuit.

BOURNEMOUTH.—Church extension scheme (£20,000), for Richmond Hill Congregational Church; Seal & Hardy, architects.

CAERPHILLY.—Boys' secondary school (£31,500), for Glamorgan E.C.; director of education, Cardiff. Additional 100 houses, for the U.D.C.; surveyor.

CARLISLE.—Housing scheme, Newtown Farm; city engineer.

CHEADLE.—School (800 places), for Cheshire E.C.; Reginald Potts, clerk, Chester.

CHESTER.—Extensive alterations, 91-95, Foregate Street, for Messrs. Starks, ladies' outfitters.

CHESTERFIELD.—Extensions, new printing department, Portland works, for Robinson & Sons, Ltd.

CHICHESTER.—Additional 100 houses, for the T.C.; town clerk.

CLIPSTONE (Notts.).—Church (£10,000); Rev. Gibbon-Pimlett.

COULSDON.—Estate development, near Coulsdon Church; Coulsdon Heights Estate Co.

FALKIRK.—Shops and wareroom for the Scottish United Loan Company, Ltd., to cost £1,400; manager of the company, 115, Wellington Street, Glasgow.

FAVERSHAM.—William Gibbs school for girls, for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

GUILDFORD.—Shops, High Street; Messrs. Hepworth. Swimming baths, Millmead; borough engineer. Assize courts; Surrey Standing Joint Committee.

HAMILTON.—Housing scheme (24), Eddlewood, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

HAMPSHIRE.—Police buildings in various parts (£15,000); Hampshire C.C.

HARROGATE.—Secondary school, for West Riding E.C.; director of education, County Hall, Wakefield.

HILL END.—Nurses' home (for 500 nurses), mental hospital, for Herts. C.C.; county surveyor.

ILKLEY.—Electric light installation, Grammar School; governors.

KENILWORTH.—Central schools, for Warwickshire E.C.; director of education, Warwick.

LEAMINGTON.—Stores, Heathcote works; borough engineer.

LEEDS.—Electric light installation, hostel and recreation hall, Meanwood Colony; city engineer. 112 houses, York Road and Selby Road; W. J. & R. Turnbull.

LONDON (Becontree).—2,500 houses (£1,450,000); L.C.C. architect.

(Charlton, S.E.).—School, for the managers of Our Lady of Grace Catholic schools; the secretary.

(Lewisham, S.E.).—Church, Downham Way; Wesleyan Methodist Church authorities. Extensions, central library; librarian. Cinema, Downham; Councillor J. T. Hallinan, King's Hall Cinema. 1,132 houses and flats, Downham estate (£710,000); L.C.C. architect.

(Norwood, S.E.).—Billiard room, Osburn Road; Beulah Bohemian Social Club.

(Southwark, S.E.).—Extensions, fire brigade workshops, headquarters (£8,190), for London C.C.; T. D. Leng, builder, Deptford, S.E.

(Woolwich, S.E.).—Additional 360 houses, Eltham, for the B.C.; borough surveyor.

(Hammersmith, W.).—Houses, Wormholt estate (£60,000); L.C.C. architect.

(Bloomsbury, W.C.).—Development of site for university purposes; Senate, London University.

(Marylebone, N.W.).—Buildings, site fronting Seymour Place, Harrowby Street and Brown Street; Hoare and Wheeler.

(Kensington, S.W.).—New galleries at Leighton House; Mr. Halsey Ricardo. Flats, Threshers Place site; Wilsham Trust, Ltd.

LONDON (*continued*).

(Hackney, E.).—Additions, Shacklewell Lane; H. Bradford and Sons. Dwellings, Shore estate (£56,000); L.C.C. architect. Workshop and stores, East Bank; Mr. C. K. Codrington. Additions, Berger Road; Lewis Berger and Sons, Ltd. Buildings on site of 152-162, Mare Street, and 1-15, Well Street; Mr. H. W. Binn.

(Limehouse, E.).—86 tenements and 10 shops, Brunton Place; Stepney borough engineer.

(Balham, S.W.).—Factory, Balham Hill; Lyne & Sons. 44 houses, Broadwater Road; R. Emerson.

(Clapham, S.W.).—Development, building estate, Larkhall Rise; Daniel Smith, Oakley & Garrard, surveyors.

(Putney, S.W.).—Six shops, High Street; North, Robin and Wilsdon, architects.

(Streatham, S.W.).—84 houses, Woodmansterne and other roads; Wates, Ltd. Shops, High Road; R. T. Grove, architect. Alterations and additions, Conservative Club, Blegborough Road; G. P. & H. Barnes. Additions, Trinity Presbyterian Church, Pendennis Road; Dowsett and Jenkins, Ltd.

(Wimbledon, S.W.).—Town hall and municipal buildings, for the T.C.; town clerk. Clinic and welfare centre, Pelham Road; borough engineer. Additions, Elite Cinema, Merton Road; R. Cromie. Showroom extensions, 40, Wimbledon Hill Road; Bleach & Dorey, Ltd. 23 houses, Merton Hall Gardens estate; H. Coombe and Sons. Alterations, Sycamore Works, Merton High Street; Sycamore Works Co.

LONGTON (Staffs.).—Electrical installation, Cottage Hospital laundry; Lynam & Bloore.

LYME REGIS.—Police station (£3,582), for Dorset C.C.; T. Moss & Son, builders, Wareham.

MANCHESTER.—Sunlight department, Baguley sanatorium; medical officer.

MARPLE.—School, Nab Top sanatorium; city engineer, Town Hall, Salford.

NAPTON.—School, for Warwickshire E.C.; director of education, Warwick.

NEW MILTON.—Police station; Hampshire C.C.

NORTHAMPTON.—Schools, Rothersthorpe Road, for the borough E.C.; Alfred Fidler, borough engineer.

PENDLETON (Near Manchester).—"Super Cinema," Langworthy Road and Eccles Old Road (£35,000); Jno. Knight, architect, Manchester.

PLYMOUTH.—Workshop and stores, Union Street; Empress Radio Co., Ltd. Reconstruction, premises in Regent Street; Legg-Wilson, Ltd.

PORTSMOUTH.—Maternity hospital and child welfare centre and offices and workshops for the blind, for the T.C.; R. J. Jenkins, city engineer.

PRESTON.—Additional 450 houses, Fishwick estate, for the T.C.; borough surveyor.

PURLEY.—Hall and club, Whitecliffe Road; Purley Men's Club.

ROXBURGH.—New education offices at Newtown St. Boswells; Mr. J. P. Forbes, architect, c/o Education Authority, Newtown St. Boswells.

RUGBY.—Central schools, Kimberley Road, for Warwickshire E.C.; director of education, Warwick.

ST. NEOTS (Hunts.).—Housing scheme (26), for the U.D.C.; R. I. Weymouth, surveyor.

SANDERSTEAD.—73 houses, Grange Road; Cresswells, Ltd. Extensions, Convent School, Sanderstead Road; Dame Superior.

SEAHAM HARBOUR.—Wiring infectious diseases hospital; U.D.C. surveyor.

SHELTON (Staffs.).—Electricity installation, 21 houses, Park Avenue; G. H. Broad.

SHERBORNE (Dorset).—Church, Coombe; W. J. Gillingham, architect, Haydon.

SOUTH AFRICA (Cape Town).—Bank buildings for Savings Bank Directors, St. George Street; Mr. Morris, architect. Schools, Stirling Street; United Hebrew Committee.

SOUTHAM.—Housing scheme (22), for the R.D.C.; H. L. Welch, surveyor.

SOUTH ELMSALL (Yorks.).—Hotel, in Westfield Lane (for Carter's Knottingley Brewery Company, Ltd.); Garside and Pennington, architects, Ropergate, Pontefract.

STAFFS.—Admission hospital (£50,000), for the Staffs. Mental Hospitals Board; county architect, Stafford.

WELLING.—School, Wickham Street (£13,776), for Kent E.C.; Clarke & Leahy, Ltd., builders.

WHITSTABLE.—County school for girls, for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

WORTHING.—Schools, for St. Joseph's Roman Catholic managers; Rev. C. M. Westlake.

YORK.—Cinema, Goodramgate; National Electric Picture Theatre.